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# FLYING QUALITIES EVALUATION OF THE F-4E WITH THE RETROFIT TWO-POSITION MANEUVERING SLAT KIT

BILLY R. BOXWELL Project Engineer CECIL W. POWELL Major, USAF Project Pilot/Officer

RUSSELL C. HUBENET Sergeant, USAF Flying Qualities Engineer

TECHNICAL REPORT No. 72-35

**AUGUST 1972** 

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# LIMITED PERFORMANCE AND FLYING QUALITIES EVALUATION OF THE F-4E WITH THE RETROFIT TWO-POSITION MANEUVERING SLAT KIT

BILLY R. BOXWELL Preject Engineer CECIL W. FOWELL Major, USAF Project Pilot/Officer

RUSSELL C. HUBENET Sergeant, USAF Flying Qualities Engineer

PROJECT AGILE EAGLE

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#### **FOREWORD**

This report presents the results of the Air Force/McDonnell Douglas performance and flying qualities evaluation of the F-4E with the production retrofit two-position maneuvering slat kit. These tests were conducted at the McDonnell Douglas flight test facility, St. Louis, Missouri, between 30 March and 25 May 1972, and at the Air Force Flight Test Center, Edwards AFB, California, between 31 May and 22 June 1972. Testing was conducted under the authority of Headquarters Air Force Systems Command as directed by AFFTC Project Directive 72-27 and ASD message R 0814102 March 1972.

This report contains the test techniques, major results, conclusions and recommendations, substantiating data, and data reduction and analysis methods. Findings of the TAC evaluation will be published by TAC under separate cover.

Pilots who participated in the test program were Major Cecil W. Powell, Lieutenant Colonel Richard E. Lawyer, and several pilots from McDonnell Douglas flight test. The two TAC flights were flown by Major M.B. Johnson (Hq TAC) and Major H.W. Dibble (Hq USAFTAWC).

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Prepared by:

Billy K. Boxwell
BILLYOR. BOXWELL
Project Engineer

Russell C. Hubert.
RUSSELL C. HUBENET

Sergeant, USAF Flying Qualities Engineer

CECIL W. POWELL Majer, USAF Preject Pilot/Officer Reviewed and approved by:

14 August 1972

JAMES W. WOOD
Colonel, USAF

Commander, 6510th Test Wing

ROBERT M. WHITE

Brigadier General, USAF

Commander |

#### **ABSTRACT**

This report presents the results of the limited performance and flying qualities evaluation of the F-4E with the production retrofit two-position maneuvering slat kit. The objective of the testing was to evaluate the performance and flying qualities of the F-4E aircraft equipped with the two-position leading edge slat and to obtain data necessary to update the F-4 Flight Manual. The two-position slat test results show an increase in turning capability in most of the flight envelope compared with that of the basic F-4E, and were comparable to those obtained with the previous fixed slat configuration, Agile Eagle The normal takeoff rotation technique described in the Flight Manual was considered unsatisfactory for slat-equipped aircraft. The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the F-4 aircraft slightly. Cruise data obtained during the tests show a degradation in cruise performance of approximately four percent for the retracted slat configuration and seven percent for the extended slat. Decreased static stability made precise control of angle of attack (AOA) moderately difficult during landing approaches at 19 units AOA. Rudder rolls performed at high AOA. showed improved performance. Lateral-directional flying qualities in the power approach configuration were generally not as good as with the unslatted F-4E, but were satisfactory. Tests performed to evaluate the flying qualities with simulated failures in one or more slat actuators revealed minor, acceptable degradations from the flying qualities observed with the symmetric slat condition.

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## list of abbreviations and symbols

Item	<u>Definition</u>	Units
A/B	afterburning	
AND	aircraft nose down	
ANL	aircraft nose left	
ANR	aircraft nose right	
AOA	angle of attack	deg or units
$c_D$	drag coefficient	dimensionless
cg	center of gravity	percent mean aerodynamic chord
$c_\mathtt{L}$	lift coefficient	dimensionless
$c_{N}$	normal force coefficient	dimensionless
CO	combat configuration	
CR	cruise configuration	
D	drag	1b
EROS	Eliminate Range Zero System	
EXI	extended	
$\mathbf{F}_{\mathbf{n}}$	engine net thrust	1b
FPA	flightpath acceleration	g
g	acceleration of gravity	32.17405 ft per sec <sup>2</sup>

Item	<u>Definition</u>	Units
KIAS	knots indicated airspeed	kt
L	landing configuration	
LWD	left wing down	
M	Mach number	
MAC	mean aerodynamic chord	
MDC	McDonnell Douglas Corporation	
MLG	main landing gear	
n,nz	normal load factor	g
PA	power approach configuration	
PIO	pilot-induced osciÍlation	
pps	pulses per second (frequency)	
p	dynamic pressure	lb per ft <sup>2</sup>
R/C	rate of climb	ft per min
RET	retracted	
RWD	right wing down	
S	aircraft wing area	530 ft <sup>2</sup>
SAS	stability augmentation system	
T	absolute temperature	deg K
TAC	Tactical Air Command	
TAWC	Tactical Air Warfare Center	
TED	trailing edge down	
TEL	trailing edge left	
TER	trailing edge right	
TEU	trailing edge up	
TLF	thrust for level flight	
TO	takeoff configuration	
V	airspeed	kt
W	aircraft gross weight	1b
δs	stabilator deflection	deg

#### INTRODUCTION

The objective of the testing was to evaluate the performance and flying qualities of the F-4E aircraft equipped with the two-position leading edge slat and to obtain data necessary to update the F-4 Flight Manual (reference 1). Fifty-eight flights were flown accumulating 59.7 flight hours, including two qualitative flights by TAC pilots.

In 1969, in an effort to improve the air combat maneuvering capabilities of the F-4 aircraft, the McDonnell Douglas Corporation (MDC) conducted a design and flight test program to investigate increased lift potential using wing leading edge slats. A USAF/USN/USMC flight evaluation was conducted in August 1969 on a YRF-4C equipped with fixed leading edge slats (reference 2). As a result of the improved maneuvering capability, a movable slat system was proposed for production F-4E aircraft which would consist of a hydraulically-actuated, two-position mechanism designed to extend the slats when the angle of attack (AOA) reached some predetermined value.

MDC continued development, corrected the deficiencies noted in reference 2, and installed the refined slats on a production F-4E. In April 1971, October 1971, and again in December 1971, further improved versions of the fixed slat were evaluated by the USAF (references 3, 4, and 5). The optimum fixed slat design, which resulted from the above tests, was mechanized for the two-position configuration and installed on F-4E USAF S/N 66-287A (figures 1 through 6), and an evaluation was conducted by MDC and the USAF. This report presents the results of those tests.

Table I is a summary of the basic configurations flown during the test program and referred to in the text. Table II and figures 7, 8, and 9 present the test loadings that were flown.

The test airplane was a production F-4E instrumented for performance and flying qualities testing. The configuration of the airplane had not been altered except for the removal of production equipment not required in the flight test program and installation of test instrumentation equipment in its place. The radar was replaced by an instrumentation package designed and installed by MDC which contained a magnetic tape airborne data recording system and other major components. The instrumentation package can be seen in figure 10.

A test noseboom was also installed with a pitot-static head for the measurement of airspeed and altitude, and vanes to facilitate the measurement of angle of attack, angle of sideslip, and flightpath acceleration. The noseboom can be seen in figure 11.

The test aircraft required no flight restrictions other than normal Flight Manual limits, with the exception of AOA and normal acceleration which were 32 units and 80 percent of Flight Manual limits. respectively. The normal acceleration limit of 80 percent will be observed on all two-position slat equipped F-4 aircraft until the flight loads testing is completed by MDC. Normal two-position slat operation limits are described in table I.

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All references to the Flight Manual in this report are to T.O. 1F-4C-1 (Combined Flight Manual USAF Series F-4C, F-4D, and F-4E Aircraft), dated 15 August 1971, Change 2, 15 December 1971.

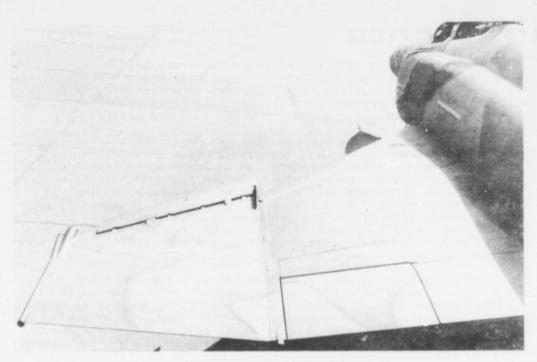


Figure 1 Slat Configuration (Slats Retracted)

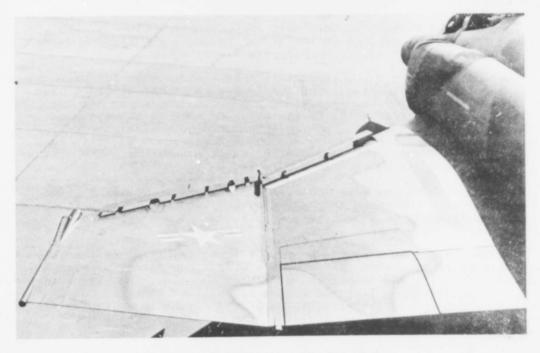


Figure 2 Slat Configuration (Slats Extended)

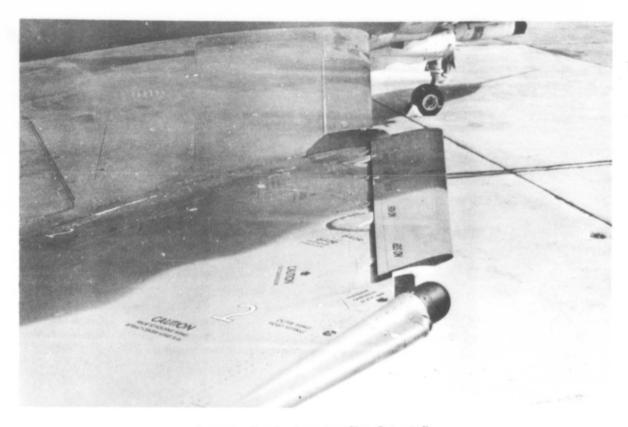


Figure 3 Slat Configuration (Slats Retracted)

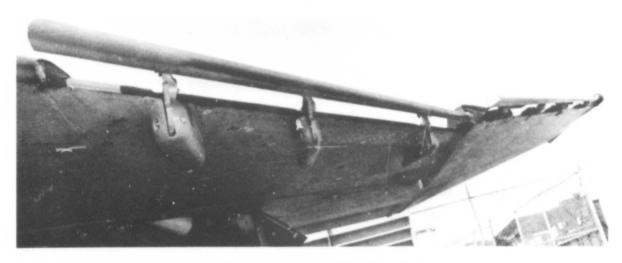


Figure 4 Slat Configuration (Slats Extended)

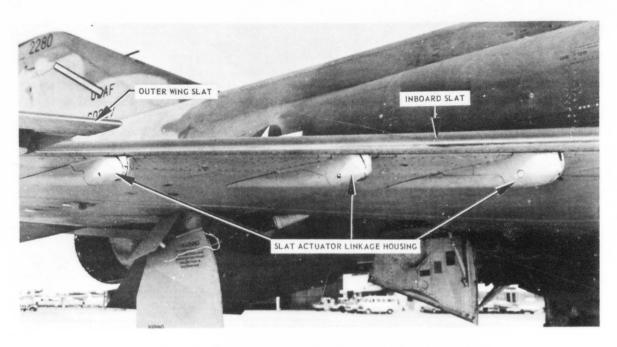


Figure 5 Slat Configuration (Slat Actuator Linkage Housing)

Table I
AIRCRAFT CONFIGURATIONS

Configuration (abbreviation)	Thrust	Gear	Flaps	Slat Position
Takeoff (TO)	MIL or MAX	DOWN	DOWN (30°)	Extended
Cruise (CR)	TLF	UP	UP	Extended or Retracted <sup>2</sup>
Combat (CO)	Augmented	UP	UP	Extended or Retracted
Power Approach (PA)	TLF	DOWN	DOWN (30°)	Extended
Landing (L)	IDLE	DOWN	DOWN (30°)	Extended

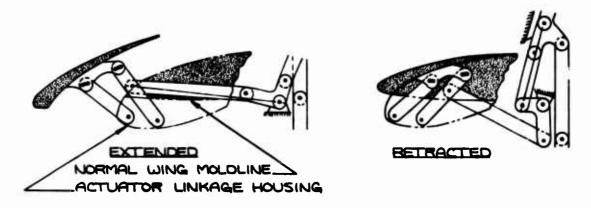
#### Notes:

Trailing edge flaps on two-position slat-equipped aircraft are 30 degrees TED when in the DOWN position. No intermediate position is available.

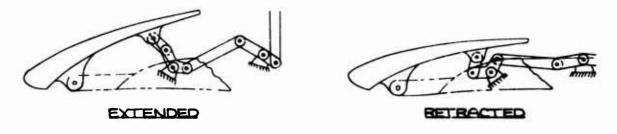
<sup>&</sup>lt;sup>2</sup>In the cruise and combat configurations the slats may be extended or retracted depending upon the AOA of the aircraft. The slats automatically extend when the AOA reaches 10 units and retract at 8 units. For a complete description of slat/flap control see the Description of the Two-Position Slat Installation section.

<sup>&</sup>lt;sup>3</sup>Speed brakes are retracted unless specifically noted otherwise.

## F-4E USAF S/N 66-287A TWO POSITION WING LEADING EDGE SLAT SCHEMATIC



#### INBOARD SLAT MECHANISM



OUTER WING SLAT MECHANISM

Figure 6 Inboard and Outer Wing Stat Mechanism Schematic



TABLE II LOADING SUMMARY F-4E USAF S/N 66-287A J79-GE-17 ENGINES

Loadingl	Engine Start Gross Weight	Drag <sup>2</sup> Index No.	Stability Index No.	9	I 8	7	F	use	lage Station	3	1 2	
1	45,276	3.2	0	-	-	-	-	-	EROS Pod <sup>3</sup>	-	~	-
2	50,702	16.0	40.0	Sgt Fletcher 370-gallon external fuel tank with pylon	-	-	-	-	EROS Pod	-	-	Sgt Fletcher 370-gallon external fuel tank with pylon
3	52,333	41.6	129.0	Sgt Fletcher 370-gallon external fuel tank with pylon	MAU-12 pylon TER-9A rack 2 empty LAU-10 rocket launchers		-	-	EROS Pod		MAU-12 pylon TER-9A rack 2 empty LAU- 10 rocket launchers	Sgt Pletcher 370-gallon external fuel tank with pylon

#### Notes:



Figure 7 Test Airplane Loadings (Loading 1: No External Stores)

Prefix "A" denotes asymmetric fuel load in the 370-gallon external tanks (right tank half full, left tank empty). Suffix "a" denotes AIM-7 missiles mounted at station 6. Suffix "b" denotes AIM-7 missiles mounted at stations 3 and 7.

<sup>&</sup>lt;sup>2</sup>These drag index numbers are valid with the leading edge slat in the retracted position. The drag index for the F-4E with the slat retracted is 3.2; this information was not available for the extended slat configuration at the time of the preparation of this report.

<sup>&</sup>lt;sup>3</sup>The EROS Pod on station 4 is an AIM-7 shaped container housing an airborne anti-collision system.



Figure 8 Test Airplane Loadings (Loading 2: 2 370-Gallon External Tanks)



Figure 9 Test Airplane Loadings (Loading 3: 2 370-Gallon External Tanks, 2 MER's, 4 Empty LAU-10's)

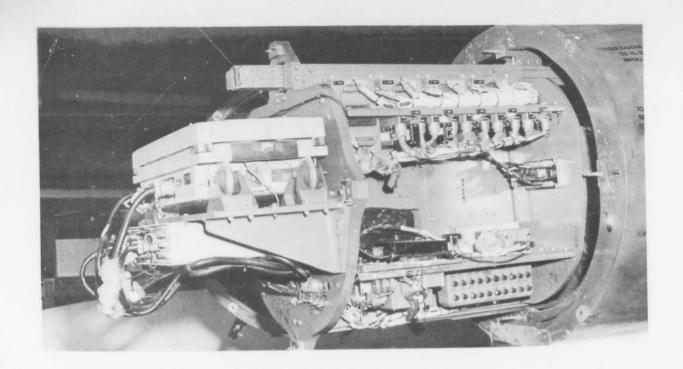


Figure 10 Test Airplane Instrumentation Package



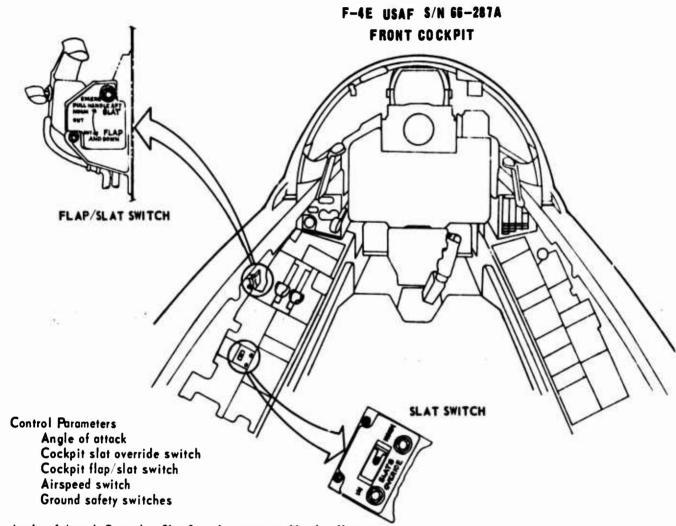
Figure 11 Test Noseboom

# DESCRIPTION OF THE TWO-POSITION SLAT INSTALLATION

Flight testing of the F-4 fixed leading edge slat has shown a significant improvement in aircraft maneuvering capability and handling characteristics at high angles of attack. The fixed leading edge slat was mechanized through the utility hydraulic system to be either fully extended or retracted. Production F-4 wing moldlines were altered to contain the inboard slat actuator linkage and structure necessary for slat actuation under high loads. (While the aircraft is maneuvering at high normal load factors and transonic speeds, the slats and associated linkage will be subject to high loads when in operation.) The slat actuator linkage housing and relative slat positions on the inboard and outer wing can be seen in figures 4, 5, and 6.

Rapid slat actuation is required to coordinate the slat extension and retraction with high aircraft pitch rates. Through sizing of hydraulic lines and restrictors, the slat actuation time is controlled to 0.5 seconds and 1.0 seconds extension for the outer wing and inboard wing, respectively, and 0.9 seconds retraction for both. These times are unaffected by wing loads. When not in the extended position, the inboard slat section is completely retractable. The outer wing slat section when retracted rotates slightly aft and down to a low drag position.

The two-position wing leading edge slats are positioned automatically through several slat actuation and control parameters, or they can be controlled manually. A slat position indicator is located on the lower left front panel in the cockpit. Slat and flap control switches are shown in figures 12 and 13 along with a resume of slat actuation and control.



Angle of Attack Control - Slat Switch in NORM, Weight off MLG

Slats extended at 10 units ACIA Slats retracted at 8 units AOA

Slats extend when flap/slat switch is positioned to OUT or OUT & DOWN

Slats retract above 600 KCAS

Manual Control - Slat Switch in SLATS OVERRIDE
Slats remain retracted at any AOA or any flap selection

Slat Control with Flap/Slat Wsitch in OUT or OUT & DOWN

Slats extended unless landing goar pin/flag installed, or 600 KIAS is exceeded, or slat override is selected

Slat Control on Ground

Power removed from flaps and slats when landing gear pin/flap installed in nosewheel well. AOA signal deactivated with weight on wheels.

Figure 12 Leading Edge Stat Control Switches



Figure 13 Leading Edge Slat and Flap/Slat Switches

#### TEST AND EVALUATION

#### PERFORMANCE TESTS

#### TAKEOFF

Tests were conducted to determine the takeoff characteristics and performance of the F-4E with the two-position slat kit installed. All performance takeoffs were recorded by Askania phototheodolite cameras from brake release through a height of approximately 200 feet. Ambient temperature, pressure, and wind speed and direction were simultaneously recorded for later data analysis.

Performance takeoffs were performed in the takeoff configuration (TO) described in table I, with maximum afterburning thrust and loading 1 (no external stores). Loading 1, which has an Eliminate Range Zero System (EROS) pod on station 4, is referred to in the text as no external stores. The pod is an AIM-7 shape weighing approximately 200 pounds and has a drag index of 1.4, both of which have negligible effect on the aircraft. With both engines operating at approximately 80 percent, brakes held, and nose gear steering engaged to insure nose gear alignment, the brakes were released and both throttles advanced to full military thrust. At this point engine speed (rpm), exhaust gas temperature, and nozzle position were checked and the throttles advanced full forward to maximum afterburning thrust. During the takeoff roll, directional control was maintained with nosewheel steering until the rudder became effective at approximately 70 KIAS.

The normal takeoff procedure outlined in the F-4E Flight Manual indicates that sufficient aft stick should be applied prior to nosewheel liftoff speed to attain the desired pitch attitude. As the nose rises, pitch attitude must be controlled to maintain 10 to 12 degrees nose up for takeoff. This technique was considered unsatisfactory for the slatequipped F-4E: early and/or rapid aft stick movement may result in over-rotation and the stabilator contacting the runway; also, slow and/or delayed aft stick movement will result in increased takeoff ground roll. The technique determined most satisfactory for slat-equipped F-4E aircraft was as follows: at approximately 80 KIAS, aft stick was smoothly applied to attain the desired 10 to 12 degrees pitch attitude just prior to liftoff. Normal takeoff procedures for slat-equipped F-4E aircraft should be changed to reflect the results of these tests. The Normal Takeoff section of the Flight Manual pertaining to rotation technique should be revised to read as follows: (R1) 2

"Aft stick should be smoothly applied at approximately 80 KIAS to attain 10 to 12 degrees pitch attitude just prior to aircraft fly-off."

The results of the takeoff tests are presented in table III and figure 15. These data were not corrected for nonstandard ambient conditions and the comparisons made with the Flight Manual were for the test day conditions.

<sup>&</sup>lt;sup>2</sup>Boldface numerals preceded by an R correspond to the recommendation numbers tabulated in the Conclusions and Recommendations section of this report.

#### Table III

TAKEOFF DISTANCE COMPARISON
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Takeoff Configuration
Dry Concrete Runway
Loading 1: No External Stores

Takeoff Gross Weight: 45,000 lb

	Ambient	Headwind	Distance to (ft)	Liftoff
Flight No.	Temperature (deg C)	Component (kt)	Two-Position Slat Test Aircraft	Flight Manual Data
279	21	5	2,580	2,500
280	31	1	2,850	2,500
281	35	5	2,500	2,800
282	26	12	2,575	2,450
283	34	5	2,675	2,720

#### LEVEL FLIGHT ACCELERATIONS

Level flight accelerations were performed to determine the speed schedules that would result in the maximum rate of climb and to check the Flight Manual schedules and level acceleration data. Data were obtained at various altitudes in both maximum afterburning and military thrust.

Level flight accelerations were performed with loading 1, from near the minimum flying speed to the limit speed for the test data. The technique used was to stabilize the airplane near the minimum flying speed. The thrust setting was advanced to military thrust or maximum afterburning as desired, and the aircraft was allowed to accelerate at a constant altitude to the maximum speed at that altitude and thrust setting. The results of the level acceleration tests are presented in figures 16 through 34. A comparison of the Flight Manual level flight envelope, the flight envelope established during F-4E Category II testing (reference 6), and the flight envelope resulting from the installation of the two-position wing leading edge slat is presented in figure 35. The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the aircraft slightly. The Flight Manual should be revised to reflect the changes in the level flight envelope for F-4E aircraft equipped with the two-position slat. (R 2)

The Flight Manual climb speed schedules for maximum and military thrust are in good agreement with the maximum rate of climb potential data presented in figures 20 and 22. It was interesting to note that when the aircraft was in a climb near its combat ceiling, the slats automatically extended when the AOA reached 10 units and the rate of climb increased rapidly by an additional 1,000 feet per minute.

Test day and standard day excess thrust and rate of climb potential were determined as outlined in the Climb Potential Determination section, appendix I, and in reference 7. Inflight thrust was obtained by use of a MDC computer program using established J79-GE-17 engine performance data. Test day thrust was determined by entering power lever position (military and maximum thrust only), altitude, Mach number, and free air temperature for the test condition into the program. Standardized thrust was obtained in the same manner except that standard altitude and free air temperature were used. Fuel flow data resulting from the level flight accelerations were not corrected for nonstandard test conditions.

#### TURNING PERFORMANCE

To evaluate the maneuvering capability of the test airplane, accelerating, decelerating, and thrust-limited turns were performed throughout the flight envelope of the aircraft in maximum afterburning thrust with loading 1 (no external stores). Accelerating turns were performed by banking the airplane into a turn at a constant normal load factor, at a speed where the excess thrust was positive and increasing, and allowing the airplane to accelerate to the thrust limit while holding as constant an altitude as possible. Decelerating turns were perperformed by banking the airplane into a turn at the completion of a level acceleration. The airplane was then turned at a constant normal load factor and altitude, and allowed to decelerate to initial stall buffet. Results of the accelerating and decelerating turns are presented in figures 36 through 49.

Maximum afterburning thrust-limited turning performance tests were conducted at 10,000, 20,000 and 35,000 feet pressure altitude with loading 1. At the test altitude an acceleration was performed to a selected Mach number. The airplane was then banked into a turn at a constant altitude while sufficient normal load factor was attained to stabilize airspeed. Approximately 360 degrees of turn were recorded during each stabilized turn. Thrust-limited turning performance data were also obtained from accelerating turns by allowing the airplane to accelerate at the test condition to near the thrust limit. These data were obtained at various cg positions from approximately 25 to 32 percent mean aerodynamic chord (MAC) and were corrected to 32.9 percent as outlined in appendix I. Thrust-limited turning performance data are presented in figure 50.

The thrust-limited turning capability presented in the F-4E Flight Manual indicates a sustained load factor higher than was demonstrated during Category II testing. These data were generated from thrust available and the airplane drag polars. Thrust-limited turning performance data obtained during the test program indicate a significant increase above the performance demonstrated during F-4E Category II testing (reference 6). The F-4E Flight Manual for slat-equipped aircraft should be revised to indicate the sustained load factor capabilities demonstrated during this test program. (R3)

Turning performance maneuvers were also used to obtain drag data by the technique outlined above. While the aircraft decelerated or accelerated in the turn at a constant normal load factor, altitude, and thrust setting a range of lift and drag coefficients were obtained. These parameters were calculated as outlined in the drag determination section of appendix I. Drag data are presented in figures 51 through

54, appendix I. These data were also corrected to a cg of 32.9 percent MAC. Performance data to be obtained from these drag polars should be corrected to a more forward cg. The cg should be approximately 28.5 percent MAC, which would be representative of the clean airplane at combat weight (41,185 pounds). (R4)

#### CRUISE PERFORMANCE

Level flight tests were conducted to obtain the change in cruise performance resulting from the two-position slat installation in both the retracted and extended positions. Data were obtained at various altitudes in loading 1.

Cruise performance data were obtained from stabilized conditions of airspeed and fuel flow at a constant weight-pressure ratio (airplane gross weight divided by the ratio of test atmospheric pressure to sea level standard day atmospheric pressure). A constant weight-pressure ratio ( $W/\delta_a$ ) was maintained by flying at successively higher altitudes to compensate for the decreasing gross weight due to fuel consumption. All data were obtained in the cruise (CR) configuration.

The results of the level flight tests are presented in figures 55 through 59. Comparisons of the test aircraft and corresponding data derived from F-4E Category II tests (reference 6) and the Flight Manual are presented in figure 55. These data show a degradation in cruise performance of up to four percent for the retracted slat and seven percent for the extended slat. The cruise performance section of the F-4 Flight Manual should be revised to reflect the cruise performance obtained during this test. (R 5)

#### STATIC THRUST CALIBRATION

A static thrust calibration was performed on 20 June 1972 at the AFFTC static thrust facility to check the installed static thrust of the J79-GE-17 engines in the test aircraft.

The gas generator data presented in figures 60 and 61 summarize the results of the static thrust calibration. With both engines operating, and with all systems on that are normally operating at takeoff, the thrust in maximum afterburning and military settings was 15,250 and 9,200 pounds per engine, respectively.

Engine speed and exhaust gas temperature operating schedules are presented in figures 62 through 65.

#### FLYING QUALITIES TESTS

#### TAKEOFF

Takeoffs were performed with several combinations of external stores, gross weight, cg position, and military or maximum afterburning thrust. The normal takeoff configuration with slats extended and flaps down 30 degrees was used for all takeoffs unless noted otherwise.

Applying full aft stick deflection prior to reaching 80 KIAS resulted in nosewheel liftoff at speeds significantly lower than obtained with the basic F-4E. The initial rotation rate was also increased.

Takeoff attitude could be attained at airspeeds that would allow liftoff at speeds too low for adequate lateral stability. Several uncommanded wing drops, similar to those reported in reference 4, occurred during the test program and were attributed to the low liftoff speeds and resulting inadequate lateral stability.

The modified takeoff technique described in the Takeoff Performance section of this report eliminated the early liftoff problem. Liftoff then occurred at a speed where lateral stability and controllability were adequate. A slight, unobjectionable forward stick deflection was needed just after liftoff to arrest rotation rate. Control forces with 3 units aircraft nose down (AND) trim were high, but not excessive during the ground run, and lightened at liftoff. Trim changes resulting from retraction of the landing gear and flaps were minor.

The external store loadings tested provided slower initial pitch rates during rotation. One takeoff performed with store loading A2 (right 370-gallon tank half full, left 370-gallon tank empty), required approximately one-half to two-thirds lateral stick deflection after lift-off to hold up the right wing.

One takeoff was made with the slats initially retracted, then allowed to extend just after liftoff. The resulting transients and trim changes were barely noticeable.

#### TRIM CHANGES

Trim changes resulting from actuation of the landing gear, speed brakes, flaps, and leading edge slats were evaluated. In the normal gear-down speed range, extension and retraction of the landing gear produced a negligible pitch trim change. Flap extension caused a definite, easily controlled, nose down trim change comparable to that of the basic F-4E. Speed brake actuation caused a moderate, easily controlled, nose up trim change (opposite in direction from that of the basic F-4E).

Trim changes occurring with normal slat extension and retraction were insignificant. The aircraft response to slat extension at 10 units AOA was a very slight nose down trim change. Using manual slat control to extend the slats at AOA's other than the normal operating point did not produce any unsatisfactory characteristics. Trim changes due to asymmetric slat extension are discussed in the Asymmetric Slat Conditions section of this report.

#### MANEUVERING STABILITY

Maneuvering stability was evaluated by performing constant Mach number windup turns over a wide range of trim Mach numbers at two altitudes. All the data presented are for the aircraft with AIM-7 stores only (loadings la and lb). The windup turns were performed by trimming the aircraft for level flight at the chosen altitude and Mach number then banking into a turn while increasing load factor. Altitude was sacrificed to maintain constant Mach number. The throttles and longitudinal trim were not moved during the maneuvers. Figures 66 through 75 show the maneuver points determined from figures 76 through 85. Figures 86 through 99 show the stick force and stabilator position data obtained during the maneuvers. The method used to determine the maneuver

points is described in appendix I. Figures 100 through 111 show time histories of several of the windup turns performed.

For subsonic speeds at 37,000 feet altitude, windup turns performed with an aft cg position showed low or negative stability for most of the range of normal force coefficient  $(C_N)$  below 0.9. The effect was most noticeable in the 13 to 16 degree noseboom angle of attack range (17 to 20 units production indicator AOA). At  $C_N$ 's above approximately 0.9, a rapid increase in stick force per g and stabilator position per  $C_N$  gradients was noted. This gradient increase was similar in nature to that reported in references 4 and 5, but reduced in effect. The aircraft's pitch response and pitch rate capability at high  $C_N$ 's were satisfactory, and the increased stick force and deflection needed to attain  $C_N$ 's greater than 0.9 provided additional security against inadvertently exceeding safe AOA limits.

The test aircraft was not fitted with a gunsight, but simulated air-to-ground and air-to-air tracking (with an unslatted F-4 target) showed that terminal tracking could be effectively accomplished up to 30 units AOA without excessive pilot workload.

#### STATIC AND DYNAMIC LONGITUDINAL STABILITY

Static longitudinal stability tests were performed at 10,000 and 35,000 feet altitudes with basic store loadings 1 and 3. The aircraft was trimmed for one-g level flight at a specified airspeed and altitude, then the airspeed was varied above and below the trim airspeed by performing a slow "push-pull" longitudinal control input. Throttle position and longitudinal trim position were not disturbed from their trim settings. Figures 112 and 113 show a summary of the data shown in figures 114 through 128 for the cruise and combat configurations. Power approach configuration data are shown in figures 129 and 130.

The effects of cg position and external store loadings on the static stability of the aircraft were comparable in nature to those experienced with the basic F-4E. Apparent and real static stability in the CR and combat (CO) configurations were determined by taking the slopes of the stick force and stabilator position versus  $C_N$  data at the trim  $C_N$  values. Store loading 1 (stability index number = 0) exhibited adequate stability, but the stability was significantly reduced by the effects of store loading 3 (stability index number = 129). Power approach configuration data for store loading 1 and a mid cg position indicate reduced stability in the 17 to 21 unit AOA range. This low static margin was noticed as difficulty in holding 19 units AOA precisely during landing approaches.

Dynamic longitudinal stability was evaluated by exciting the short-period oscillatory motion of the aircraft with a quick longitudinal control doublet or impulse input. After completing the control input, the pilot attempted to hold the stick steady in the neutral position. The aircraft's oscillatory response was computer analyzed to provide the damping ratio and damped period data shown in figures 131 and 132. Figures 133 through 141 show time histories of several of the tests.

As expected, stability augmentation system (SAS)-off oscillations had less damping than the SAS-on oscillations, and rearward cg movement reduced damping also. The period of the oscillation increased with altitude and rearward cg movement. Pilot-induced oscillations (PIO's) are

a potential problem at high speeds and low altitudes due to the low SAS-off damping, particularly with aft cg locations. No Flight Manual change is required for the slat-equipped aircraft, since there already is a NOTE describing PIO susceptibility in the Operating Limitations section of the current Flight Manual.

#### TRANSONIC SPEED STABILITY

Transonic speed stability was evaluated by trimming for level flight at approximately 0.85 Mach, then increasing the thrust to maximum after-burner and accelerating to approximately 1.2 Mach. After terminating the acceleration run, the aircraft was retrimmed for level flight, and the throttles were retarded to IDLE. During both the accelerating and decelerating runs, the pilot attempted to hold altitude constant by longitudinal control inputs. Figure 142 shows the data obtained during the level acceleration and deceleration. Figure 143 shows the transonic characteristics during high-g decelerating turns with maximum afterburning thrust. Figures 144 and 145 show time histories of the level transonic acceleration and deceleration.

Stabilator and stick force variations with Mach number were similar to those of the basic F-4E during the one-g acceleration/deceleration maneuvers. During the high-g decelerating turns, it was noted that the transonic "dig-in" characteristics of the test aircraft were much less severe than the basic F-4E's.

#### ROLL PERFORMANCE

Aileron and rudder rolls were performed at 10,000 and 35,000 feet altitude over a wide range of speeds. The maneuvers were initiated with abrupt aileron or rudder inputs from a level flight attitude or a stabilized high-g turn. The SAS was on for all tests.

Figure 146 shows roll data for the CR and CO configurations at 10,000 feet altitude. Comparable data for the basic F-4E were not available, but comments from both contractor and USAF pilots indicated that the high-AOA aileron rolling capability was slightly improved over that of the basic F-4E, while low AOA aileron roll performance was enchanged. Figures 149 and 150 show time histories of typical rolls performed at this altitude.

Roll capability at 35,000 feet is shown in figure 147 for the CR and CO configurations. Aileron roll performance at high AOA's was slightly improved, while at low and mid AOA's (below 20 units) aileron roll performance was approximately the same as that of the unslatted F-4E. Rudder rolls performed at high AOA's showed improved performance, but it was noted that rudder rolling performance decreased rapidly at lower AOA's. The variation of rudder rolling performance with angle of attack was much more noticeable than with the unslatted F-4E. Figures 151 through 153 show typical roll time histories at this altitude.

Low speed roll capability in the power approach configuration is shown in figure 148. The roll helix angle was determined by the method described in appendix I. As was noted with the CR and CO configuration roll tests, low AOA aileron roll performance was approximately the same as the unslatted aircraft's, while at higher AOA's the aileron roll performance was slightly improved. The improvement over the basic F-4E of

aileron roll performance was more noticeable in the CR and CO configuration tests than in the power approach (PA) configuration rolls. Rudder roll performance depended strongly on AOA: rolls at high AOA showed slightly increased performance; while rolls at lower AOA's did not show any increase in performance. Coordinated use of both aileron and rudder inputs gave the most favorable roll response at high AOA's. Figures 154 through 156 show typical PA configuration roll time histories.

#### STATIC DIRECTIONAL STABILITY

Static directional stability was evaluated by performing sideslips in the PA and CR configurations at several trim speeds at 10,000 feet altitude. The maneuvers were performed by slowly applying rudder pedal force while using lateral stick inputs to maintain a constant heading. Figures 157 through 162 show the control and attitude parameters of the aircraft plotted against sideslip angle. Static directional stability was satisfactory throughout the envelope tested, but the increased dihedral effect of the test aircraft was noticeable. Sideslips in the PA configuration caused increased difficulty in controlling AOA. A sideslip attempted while trimmed at 24 units AOA (production indicator) could not be stabilized in bank angle or AOA at sideslip angles greater than approximately +2 degrees.

#### POWER APPROACH CONFIGURATION EVALUATION

Power approach flying qualities were evaluated with landing gear and flaps down and slats extended. In addition, landing approaches were flown with several combinations of simulated slat and flap malfunctions. These approaches are discussed in the Asymmetric Slat Conditions section of this report.

Longitudinal flying qualities were satisfactory but were adversely affected by low static stability in the 17 to 20 units AOA range. This region of reduced stability made precise control of AOA moderately difficult during landing approaches at 19 units AOA. This difficulty would have been greater without the 16-pound longitudinal control feel system overbalance modification which had been installed in the test aircraft before the testing began. Terminating the approach with a flare to 20 to 21 units AOA was easily accomplished and resulted in reduced sink rates at touchdown.

Lateral-directional flying qualities in the PA configuration were generally not as good as those experienced with unslatted F-4E's, but were still termed satisfactory. Lateral control was adequate at 19 units AOA with either aileron or rudder inputs. Due to the increased dihedral effect of the slat-extended configuration, the test aircraft was more susceptible to roll disturbances caused by gusty crosswinds. This susceptibility to gust upsets was especially noticed just before touchdown where lateral control effectiveness was reduced by ground effect.

Figure 163 shows the approach speed data gathered during the tests. Approach speed with slats and flaps extended was approximately 7 knots higher than experienced with the unslatted aircraft. Although no landing data are included in this report, the following observations were made for the slat-equipped F-4E:

 The aircraft had increased residual thrust during landing roll due to the lack of a BLC installation. 2. Approach speeds were higher and drag was reduced due to the lower maximum flap deflection.

These changes all tended to increase the stopping distance during landings. Landing performance tests should be conducted to insure that accurate data are presented in the Flight Manual for the slat-equipped F-4E aircraft. (R6)

#### STALL APPROACH CHARACTERISTICS AND AURAL TONE STALL WARNING SYSTEM

Stall approach characteristics were evaluated with several combinations of aircraft configuration, external stores, load factors, and slat conditions. Figure 164 shows a summary of the results, and figures 165 through 169 show time histories of several of the tests. The buffet onset data shown in figure 164 are incomplete because pilot comments noting buffet were not available for all the stall approaches flown. The wing rock onset data shown were obtained from the time histories of the maneuvers.

The aerodynamic stall warning characteristics of the test aircraft were generally better than those of the previously-evaluated slat configurations (references 2, 3, 4, and 5). Stall warning from wing rock or yaw oscillations, which occurred at 25 to 27 units AOA usually, was considered unreliable due to the non-repeatability of the characteristics. If the 24- to 27-unit AOA range was traversed at a moderately high pitch rate, it was possible to increase AOA to 32 units without any wing rock or directional instability. Buffet was of limited usefulness as a stall warning because of the large range between buffet onset AOA's and actual stall/loss of control AOA. The buffet levels were of lower intensity at all AOA's than those of the basic F-4E, and were mild enough not to mask the other aerodynamic stall warnings. The increase in stick force and position gradients at high  $C_{\rm N}$ 's, as discussed in the Maneuvering Stability section of this report, acted as an effective deterrent to exceeding safe AOA limits.

The aural tone stall warning system was scheduled by angle of attack as shown in figure 170. Because of the increased angle of attack capability of the slat-equipped aircraft, and the slightly improved aerodynamic stall warning, artificial stall warning was less critical than in the basic F-4E. The aural tone high schedule (figure 170) was defined from pilot comments obtained from previous slat tests. When considering the most favorable qualitative combination of turning performance and high angle of attack flying qualities, the 23- to 25-unit AOA range was considered the maximum maneuvering angle of attack. However, it should be noted that load factor limits of the aircraft can be attained at decreased AOA's in the low altitude regions of the flight envelope. In addition, thrust-limited turning capabilities of the aircraft were not considered in determining this maximum maneuvering AOA. The aural tone system, as presently scheduled, is effective as both a stall warning device and a maneuvering capability indicator.

#### ASYMMETRIC SLAT CONDITIONS

#### General

Several test flights were utilized to fully evaluate flying qualities with simulated failures in one or more slat actuators. All the flights

were flown with no external stores except the EROS pod (loading 1). The slat asymmetry referred to in the following sections is defined as both slats on one wing retracted and both slats on the opposite wing extended.

#### Trim Changes

Longitudinal trim changes accompanying asymmetric slat actuation were similar to those noted for normal symmetric slat extension. The trim change was barely perceptible both at one g and at elevated load factors. The asymmetric actuation was noted mainly as a tendency to roll into the wing with retracted slats. Little yaw resulted from asymmetric actuation at 10 units AOA.

#### High AOA Characteristics

The rolling tendency of the asymmetric slat configuration increased with angle of attack. Lateral control requirements as a function of angle of attack are shown in figure 171. At approximately 19 units AOA (production indicator), full lateral stick deflection toward the wing with extended slats was required to control bank angle. Above 19 to 20 units AOA, rudder inputs were helpful in controlling the increasing rolling tendency.

Light buffet onset was noted at the slat extension AOA during asymmetric actuation at one g. Moderate buffet was noted at 18 to 19 units AOA during one-g stall approaches. Wing rock and yaw oscillations did not occur consistently, but did sometimes begin in the AOA range of 23 to 26 units.

Windup turns were performed at 35,000 feet with the asymmetric slat extension. The general characteristics and lateral control requirements were similar to the one-g characteristics, except for the roll-off starting at 20 to 21 units AOA being more abrupt and not controllable with rudder inputs. The maneuvers were terminated when the roll-off started. Moderate buffet onset was at 16 to 17 units AOA. Dig-in characteristics during high-g transonic decelerations were less severe than those experienced with the basic F-4E and comparable to the symmetric slat condition characteristics.

#### Power Approach Configuration

A 19-unit AOA approach was flown with the asymmetric slat condition and gear and flaps down. Longitudinal controllability was similar to that noted during normal symmetric slat approaches in that holding 19 units AOA precisely was moderately difficult. Lateral-directional controllability was sufficient at 19 units AOA. Approach speed with the asymmetric slats was 4 to 5 knots higher than the normal symmetric slat approach speed.

One 19-unit approach was flown with gear and flaps down and all slats retracted. Buffet intensity was noticeably higher, but angle of attack control was easier than with the slats extended. Lateral and longitudinal controllability was sufficient throughout the approach. Approach speed at 19 units AOA was approximately the same as with extended slats.

Two approaches were flown with normal slat extension and retracted flaps. Pilot comments indicate increased workload and difficulty in controlling sink rate. Approach speed was increased by 15 to 20 knots.

One approach at 19 units AOA was flown with both slats and flaps retracted. Lateral controllability was poor; the ailerons were not effective, and rudder inputs were necessary for adequate roll response. Approach speed was approximately 20 knots above the normal slats out, flaps down speed.

Table IV summarizes the results of the different slat/flap combinations tested. This information should be included in the Flight Manual for slat-equipped aircraft. (R7)

#### ANGLE OF ATTACK INDICATIONS

An inflight, out-of-ground-effect calibration of the production angle of attack indicator versus noseboom angle of attack is shown in figure 172. The shift in calibration between the PA and CR configurations is similar to that of the basic F-4E, and is attributed to the airflow disturbance caused by the nose landing gear door when the gear is extended. Slat position appeared to have no effect on the calibration.

Table IV
ASYMMETRIC SLAT TEST SUMMARY

Slat Position	Flap Position	Approximate Change in Approach Speed	Comments
Right - retracted Left - extended	30° down	+4 to 5 kt	Lateral control adequate.
Retracted	30° down	None	Buffet intensity higher, AOA control easier.
Extended	Retracted	+15 to 20 kt	Sink rate hard to control.
Retracted	Retracted	+20 kt	Poor lateral controllability.

#### Notes:

Increase in approach speed above a normal flaps down (30 degrees),
slat extended approach at 19.2 units AOA.

<sup>&</sup>lt;sup>2</sup>All approaches were flown at 19 units ADA.

## CONCLUSIONS AND RECOMMENDATIONS

The two-position slat test results show an increase in turning capability in the subsonic portion of the flight envelope compared with that of the basic F-4E, and were comparable to those obtained with the previous fixed slat configuration, Agile Eagle IV. Flying qualities of the slatted F-4E were basically comparable to those of the unslatted aircraft. Most noticeable in the flying qualities area was the increased maneuvering capability at high angles of attack.

The takeoff rotation technique described in the Flight Manual was considered unsatisfactory for the slat-equipped F-4E: early and/or rapid aft stick movement may result in overrotation and the stabilator contacting the runway; slow and/or delayed aft stick movement will result in increased takeoff ground roll.

The Normal Takeoff section of the Flight Manual pertaining to rotation technique should be revised to read as follows (page 12):

"Aft stick should be smoothly applied at approximately 80 KIAS to attain 10 to 12 degrees pitch attitude just prior to aircraft fly-off."

The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the aircraft slightly.

2. The Flight Manual should be revised to reflect the changes in the level flight envelope for F-4E aircraft equipped with the two-position slat (page 13).

Thrust-limited turning performance obtained during this test program indicated a significant increase above that demonstrated during F-4E Category II testing (reference 6).

3. The F-4E Flight Manual for slat-equipped aircraft should be revised to indicate the sustained load factor capabilities demonstrated during this test program (page 14).

The drag data presented were corrected to a cg position of 32.9 percent MAC.

4. Performance data to be obtained from these drag polars should be corrected to a more forward cg. This cg should be approximately 28.5 percent MAC, which would be representative of the clean airplane at combat weight (41,185 pounds) (page 15).

The cruise data obtained during the tests show a degradation in cruise performance of approximately four percent for the retracted slat configuration and seven percent for the extended slat.

5. The cruise performance section of the F-4 Flight Manual should be revised to reflect the cruise performance obtained during this test program (page 15).

The aircraft pitch response and pitch rate capability at high CN's were satisfactory, and the increased stick force and deflection needed to attain CN's greater than 0.9 provided additional security against inadvertently exceeding safe AOA limits.

Simulated air-to-air tracking tests showed that terminal tracking could be effectively accomplished up to 30 units AOA without excessive pilot workload.

Static and dynamic longitudinal stability in the cruise and combat configurations was comparable to that of the unslatted F-4E. However, in the power approach configuration with no external stores and a mid cg position reduced static stability was noted in the 17 to 21 units AOA range. This region of reduced stability made precise control of AOA moderately difficult during landing approaches at 19 units AOA.

Transonic "dig-in" characteristics of the slat equipped test aircraft were much less severe than those of the basic F-4E.

The high-AOA aileron rolling capability was slightly improved over the basic F-4E, while low AOA aileron roll performance was unchanged. Rudder rolls performed at high AOA's showed improved performance, but reduced rapidly at lower AOA's. Coordinated use of both aileron and rudder inputs gave the most favorable roll response at high AOA.

Static directional stability was satisfactory throughout the flight envelope tested, but the increased dihedral effect of the test aircraft was noticeable.

Lateral-directional flying qualities in the power approach configuration were generally not as good as experienced with the unslatted F-4E, but were still termed satisfactory.

The F-4E aircraft equipped with the two-position leading edge slat had increased residual thrust during the landing roll due to the deleted BLC system. This, combined with the higher approach speeds and reduced drag caused by the lower maximum flap deflection, would tend to increase the stopping distance during landing.

6. Landing performance tests should be conducted to insure that accurate data are presented in the Flight Manual for the slat-equipped F-4E aircraft (page 20).

The aerodynamic stall warning characteristics of the test aircraft were generally better than those of the previously evaluated slat configurations, as well as those of the unslatted aircraft.

Tests performed to evaluate the F-4E flying qualities with simulated failures in one or more slat actuators revealed only minor, acceptable degradations from the symmetric slat condition characteristics. Trim changes with asymmetric slat actuation were barely perceptible. The asymmetric actuation was noted mainly as a tendency to roll into the wing with retracted slats. "Dig-in" characteristics during high-g transonic decelerations were less severe than experienced with the basic F-4E and comparable to the symmetric slat extension characteristics.

A 19-unit AOA approach was flown with the asymmetric slat condition and gear and flaps down. Longitudinal controllability was similar to that noted during normal symmetric slat approaches in that holding 19 units AOA precisely was moderately difficult. Lateral-directional controllability was sufficient at 19 units AOA. Approach speed with the asymmetric slats was 4 to 5 knots higher than the normal symmetric slat approach speed.

One 19-unit approach was flown with gear and flaps down and all slats retracted. Buffet intensity was noticeably higher, but angle of attack control was easier than with the slats extended. Lateral and longitudinal controllability was sufficient throughout the approach. Approach speed at 19 units AOA was approximately the same as with extended slats.

Two approaches were flown with normal slat extension and retracted flaps. Pilot comments indicate increased workload and difficulty in controlling sink rate. Approach speed was increased by 15 to 20 knots.

One approach at 19 units AOA was flown with both slats and flaps retracted. Lateral controllability was poor; the ailerons were not effective, and rudder inputs were necessary for adequate roll response. Approach speed was approximately 20 knots above the normal slats out, flaps down speed.

7. The information contained in table IV of this report should be included in the Flight Manual for slat-equipped F-4E aircraft (page 22 ).



### APPENDIX I DATA ANALYSIS METHODS AND TEST DATA

#### CLIMB POTENTIAL DETERMINATION

Test day excess thrust was obtained during level accelerations and turning performance tests. It was then standardized and converted to rate of climb potential, or specific excess power, to enable the thrust-limited performance of the aircraft to be evaluated.

The method used to calculate rate of climb potential was based on the flightpath accelerometer (FPA) measurement. Data obtained from the FPA was very useful in yielding consistent results. To obtain climb potential the following equation was used:

$$R/C = \frac{dH}{dt} + \frac{V}{g} \frac{dV}{dt} = V \left( \frac{F_n - D}{W} \right)$$

where

R/C = test day rate of climb potential

 $\frac{dH}{dt}$  = rate of change of altitude

g = acceleration of gravity

 $\frac{dV}{dt}$  = acceleration along the flightpath

V = true airspeed

W = airplane gross weight

F<sub>n</sub> = net thrust
D = net drag

 $\frac{F_n - D}{W}$  = specific excess thrust = FPA

using the FPA to obtain R/C results in the following

$$R/C = V (FPA) 101.28$$

where

R/C = test day rate of climb potential in ft/min

V = true airspeed in knots

Rate of climb potential calculated from test conditions was corrected for nonstandard temperature effects on velocity and thrust. The temperature effect on velocity correction to rate of climb potential was obtained from the following equation:

$$V_s = V_t \sqrt{T_s/T_t}$$

where subscripts denote standard and test velocities and temperatures, respectively. The correction to rate of climb potential for nonstandard temperature effects on velocity is therefore

$$\Delta R/C_{vel} = \left(\sqrt{T_{s}/T_{t}} - 1\right) V \times FPA$$

The thrust correction to rate of climb potential for nonstandard temperature is

$$\Delta R/C_{thrust} = \frac{V_{s}}{W} (F_{n_{s}} - F_{n_{t}})$$

where

Vs = standard day true airspeed

W = airplane gross weight

Fns = standard day net thrust

 $F_{n_+}$  = test day net thrust

Since aircraft drag for a given attitude and Mach number is a function of both normal acceleration and aircraft gross weight, a correction must be made to compensate for nonstandard weight and normal acceleration. Using the test day rate of climb potential equation and evaluating it for both the test day drag,  $D_{\text{t}}$ , and the standard day drag,  $D_{\text{g}}$ , yields the rate of climb potential correction for drag.

$$R/C_{drag} = \frac{V_s}{W} (D_t - D_s)$$

where

$$D = C_D (q) S$$

$$C_D = f(C_N, M)$$

$$C_{N_S} = \frac{N_{Z_S} W_S}{q S}$$

$$C_{N_t} = \frac{N_{z_t} W_t}{q S}$$

The Market of the second

q = dynamic prescure

S = aircraft wing area

 $N_z$  = normal load factor

W = aircraft gross weight

C<sub>D</sub> = drag coefficient

s = standard day

t = test day

These relationships can be determined from the aircraft drag polars which, for this evaluation, were obtained from wind tunnel measurements. It is acknowledged that the absolute magnitudes of these drag polars may not be exactly representative of the test aircraft; however, the accuracy of these corrections is enhanced by using only small incremental changes on the drag polar.

A momentum correction to rate of climb potential was obtained using the following equation:

$$\Delta R/C_{m} = V_{s} \left( \frac{F_{n_{s}} - D_{s}}{W_{s}} \right) - V_{s} \left( \frac{F_{n_{s}} - D_{s}}{W_{t}} \right)$$

Finally, corrected rate of climb potential was obtained by combining the above corrections with test day climb potential.

$$R/C_{corrected} = R/C + \Delta R/C_{vel} + \Delta R/C_{thrust} + \Delta R/C_{drag} + \Delta R/C_{m}$$

The complete derivation of the corrections used to obtain standard rate of climb potential can be found in reference 7.

#### DRAG DETERMINATION

Drag data for the test aircraft were obtained during turning performance maneuvers. Lift coefficient was calculated using the following equation.

$$C_L = C_N/\cos \alpha$$

where

C<sub>I.</sub> = lift coefficient

 $\alpha$  = angle of attack

 $C_N = (nW)/(qS)$ 

n = normal load factor

W = aircraft gross weight

q = dynamic pressure

S = mircraft wing area

Drag for the test aircraft was calculated using the FPA and thrust available.

$$D = F_n - FPA (W)$$

where

 $F_n$  = thrust available

FPA = flightpath acceleration

W = aircraft gross weight

and

$$C_D = \frac{D}{qS}$$

The drag coefficient was then corrected to a reference cg location of 32.9 percent MAC. This correction was established using figure 14 and the following equation.

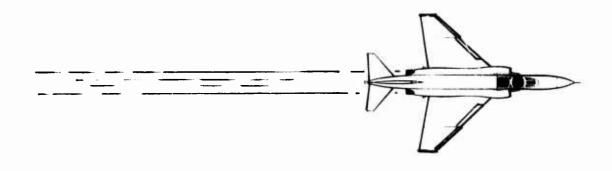
$$C_{D_{corrected}} = C_{D} + (\Delta C_{D}/\Delta cg) \Delta cg$$

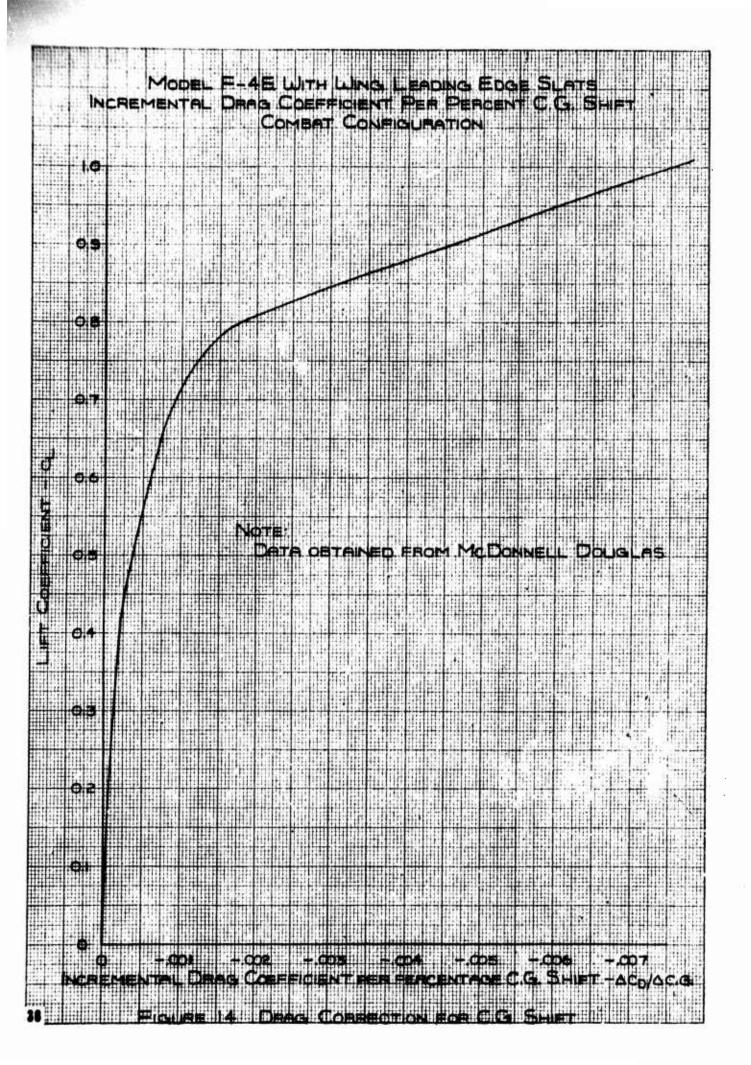
where

 $C_D$  = drag coefficient at test cg position

 $\Delta C_D/\Delta cg$  = obtained from figure 173 at the test  $C_L$ 

 $\Delta cg = cg_{test} - 32.9 percent$ 





#### DYNAMIC LONGITUDINAL STABILITY DETERMINATION

The damping ratios and damped periods shown in the short period damping data were determined by a computer program that matched the aircraft response to an ideal second order oscillatory response. The damping ratio and damped period were extracted from the equation used to generate the matching second-order oscillation.

#### MANEUVERING STABILITY DETERMINATION

Maneuver points were determined from the windup turns performed by the following method:

- 1. Slopes of the longitudinal stick force ( $F_s$ ) versus load factor (g) and stabilator position ( $\delta_s$ ) versus normal force coefficient ( $C_N$ ) were taken at several  $C_N$  values. These slopes were taken from data at both forward and aft cg locations and approximately equal altitudes, Mach numbers, and gross weights.
- 2. The slopes were plotted versus cg location, and straight lines were faired through points of equal  $C_N$  values. The intersection of the extrapolated straight lines and the slope = 0 line provided the cg location at which the slopes were reduced to zero. The cg position at which  $dF_S/dg = 0$  was called the apparent maneuver point, and the cg position for  $d\delta_S/dC_N = 0$  was the maneuver point.
- 3. The maneuver points were plotted versus  $C_{\rm N}$  for the several speeds and altitudes tested.

#### ROLL CAPABILITY DETERMINATION

Time-to-bank data were measured from the time point at which the initial control deflection occurred. Roll helix angle was calculated for the low speed roll data by the following formula:

roll helix angle = pb/2V

where

p = average roll rate for the initial 30 degrees of bank, found by taking  $30^{\circ}/(t_{30} \times 57.3)$  in radian/sec

b = aircraft wing span in ft

V = calibrated airspeed in ft/sec

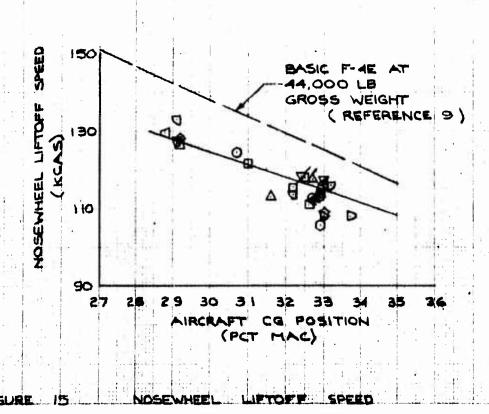


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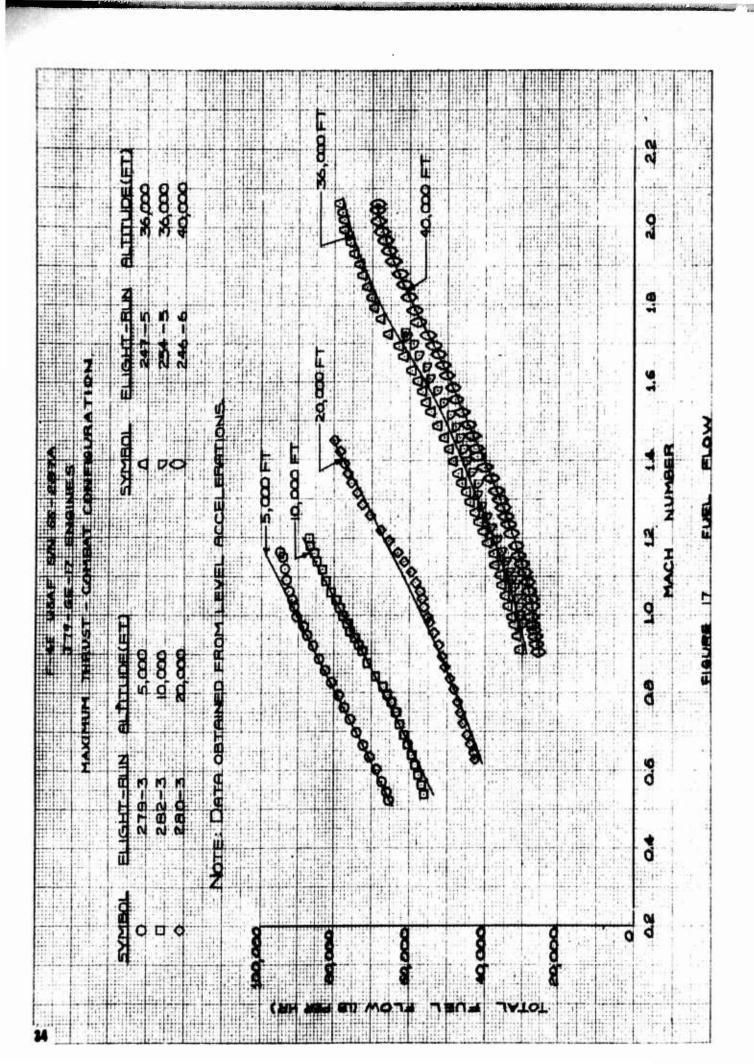
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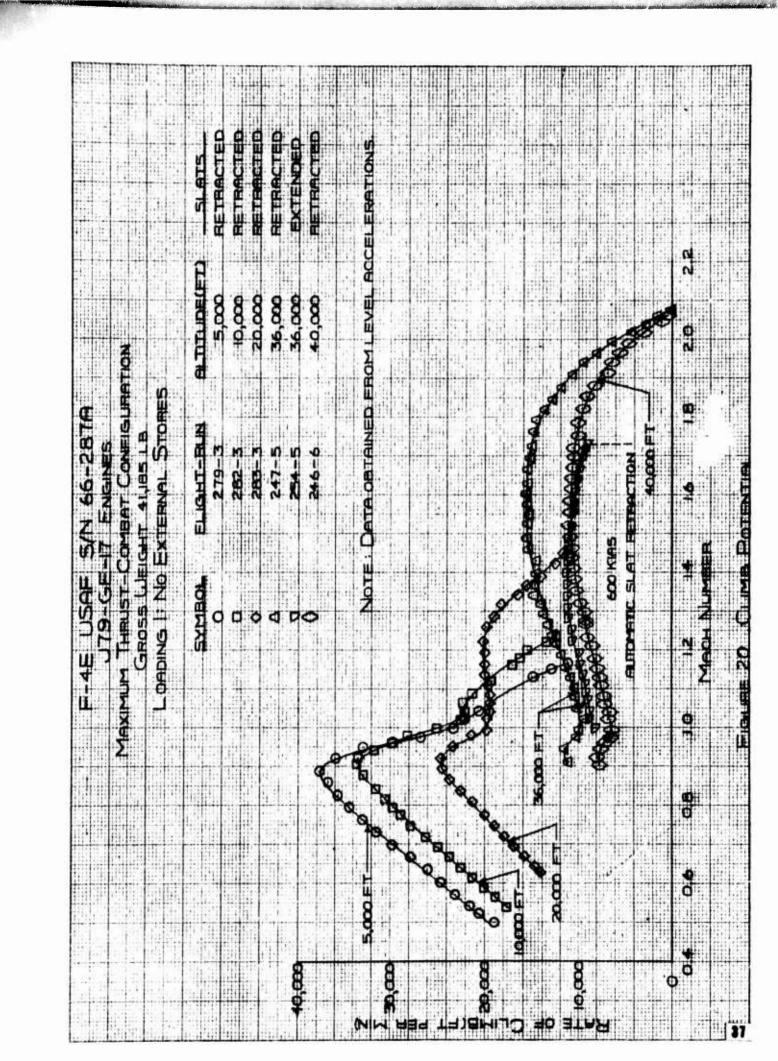


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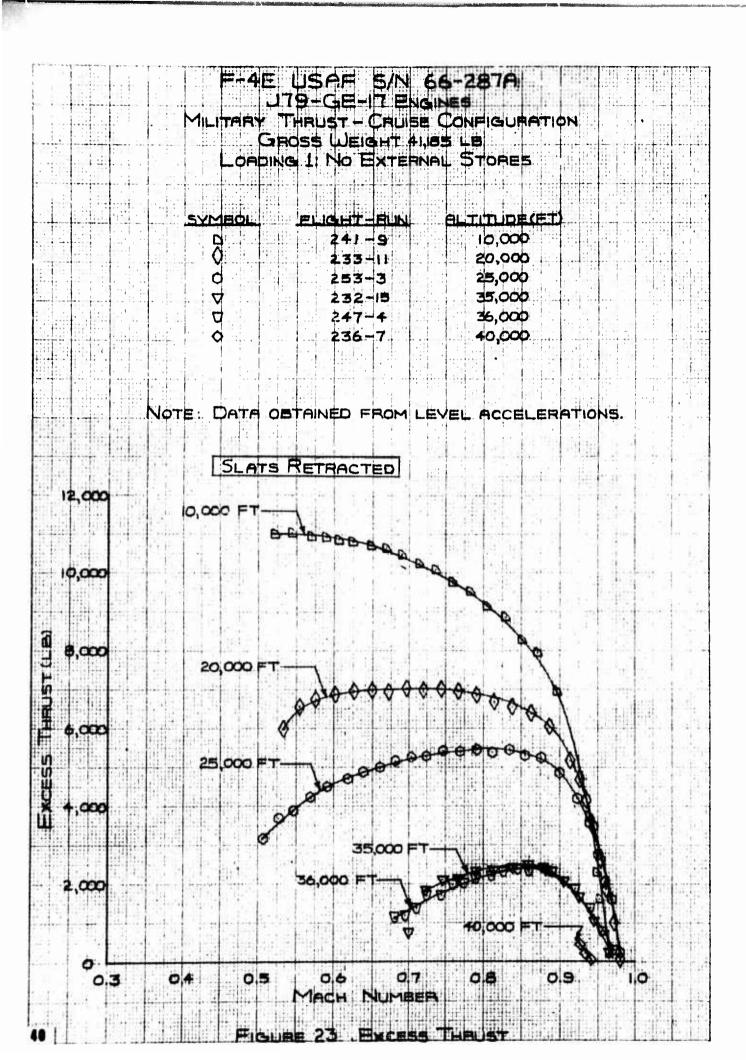
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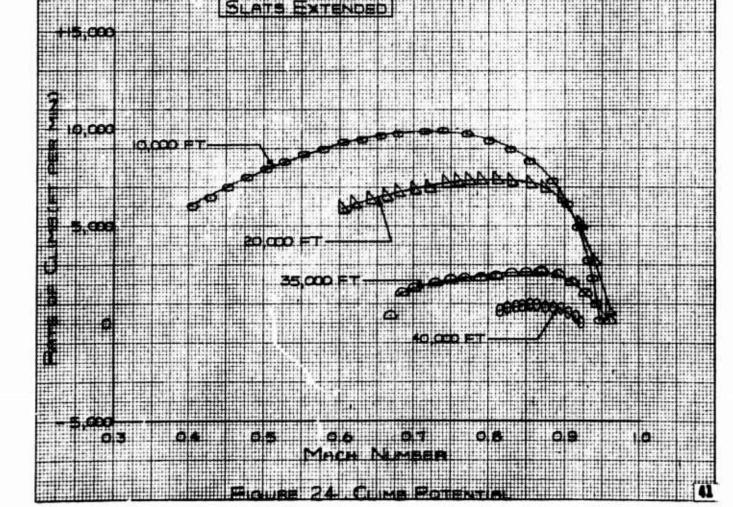
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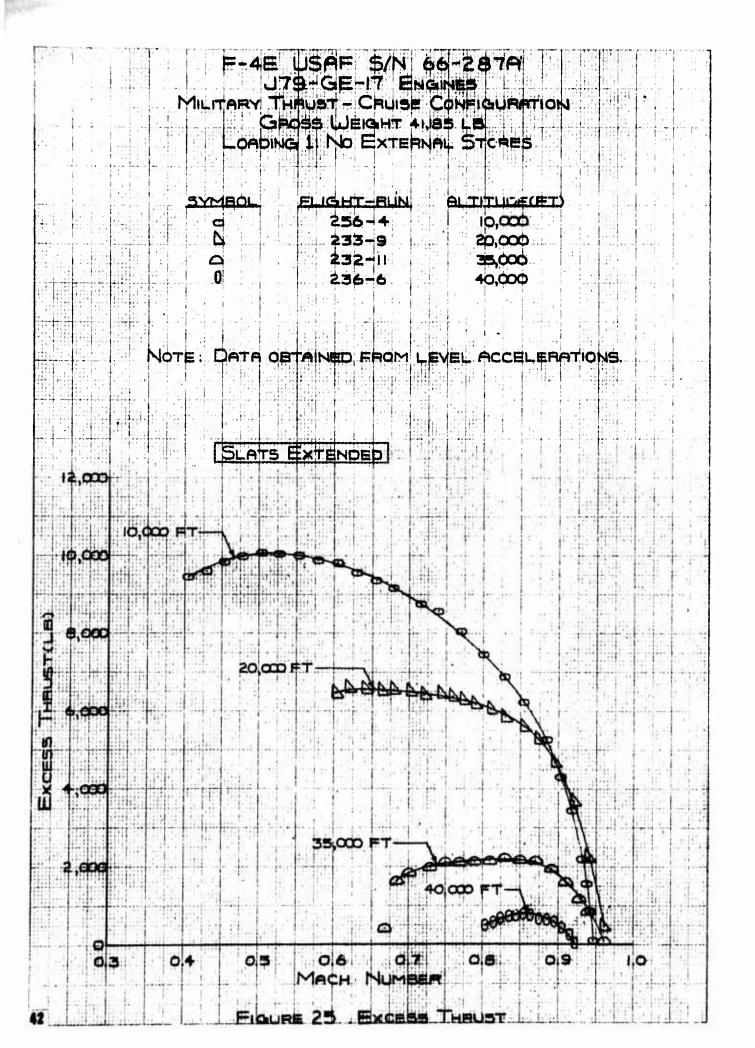


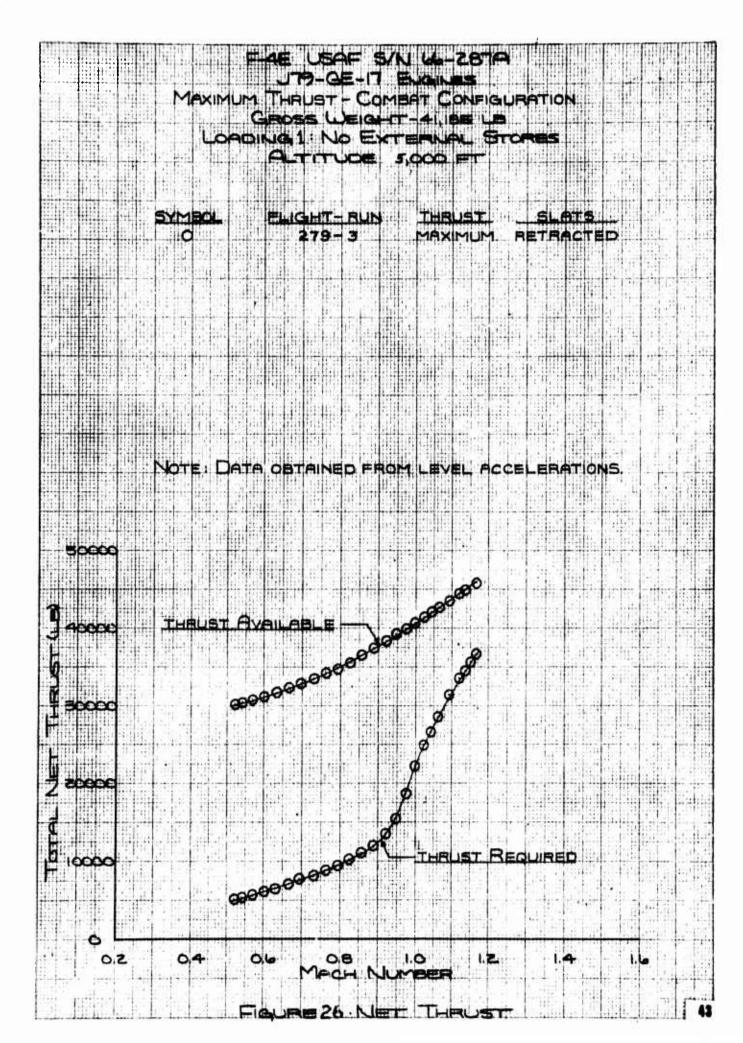
## E-48 USAF S/N 66-287A J79-GE-IT Engines Military Thrust - Cruise Configuration Gross Weight 41,85 LB Loading I: No External Stores

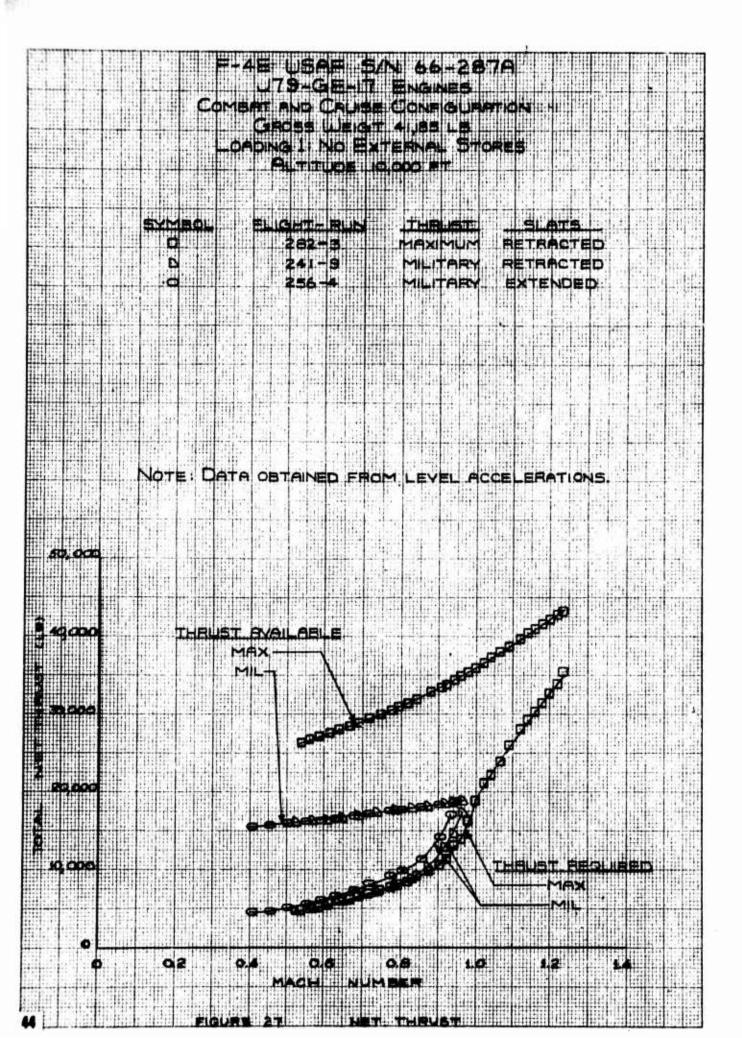
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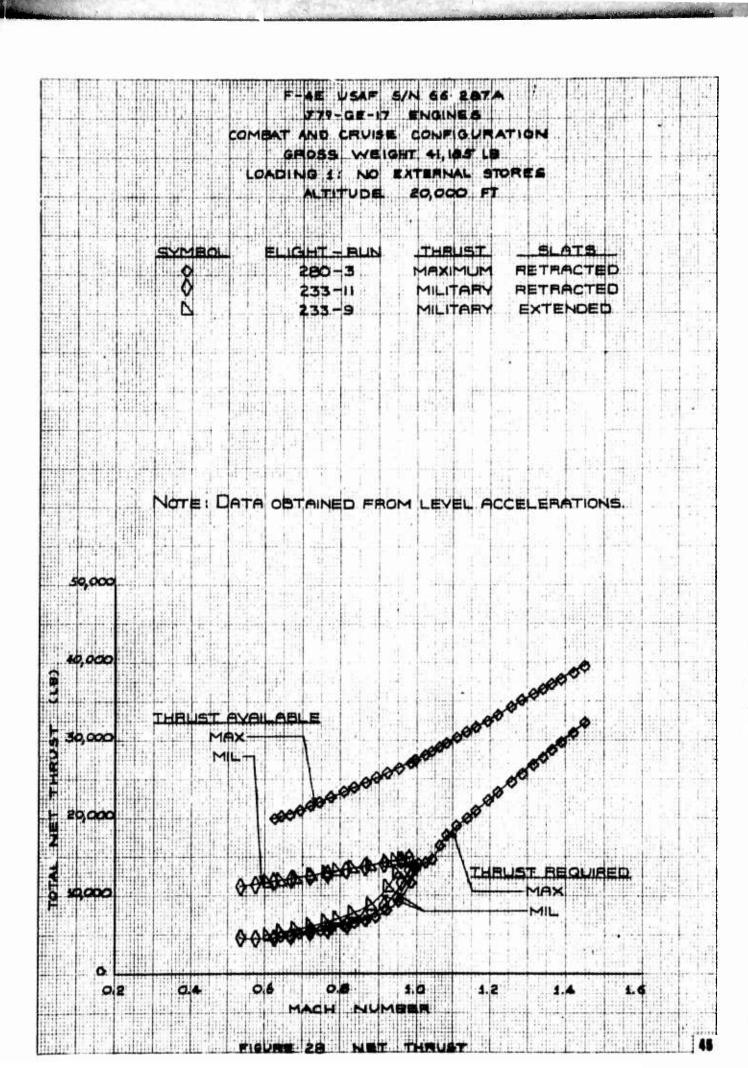
# NOTE: DATA OBTANED FROM LEVEL ACCELEBATIONS

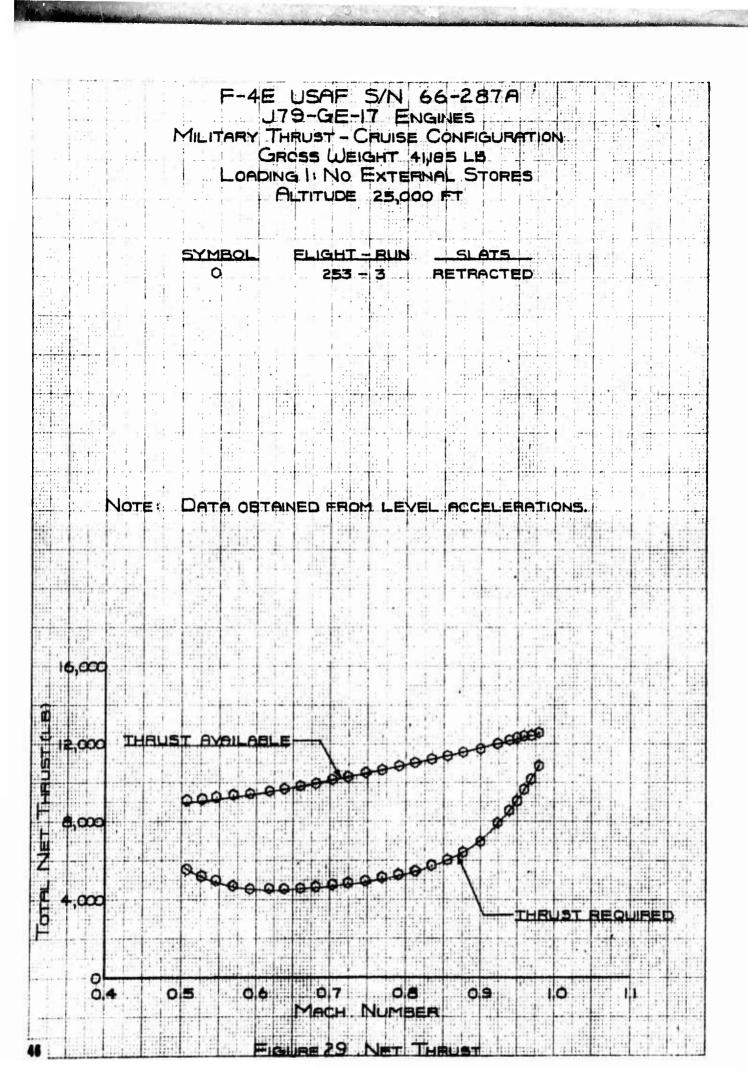


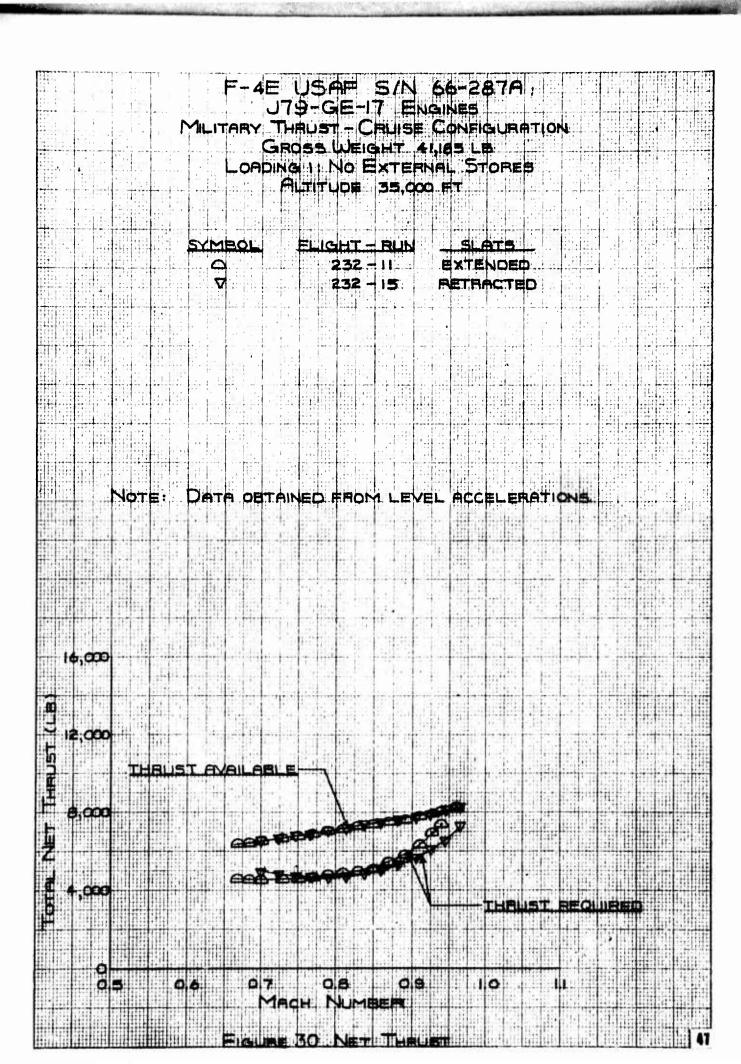




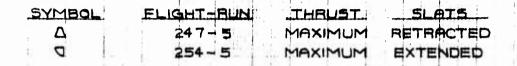


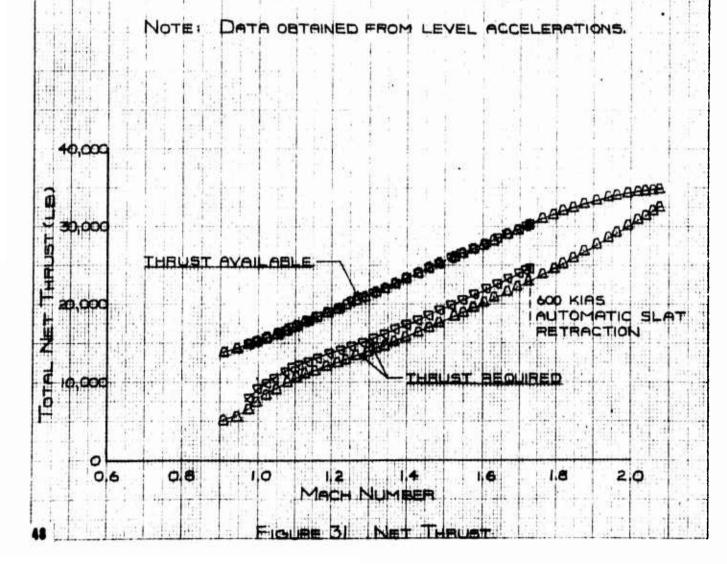


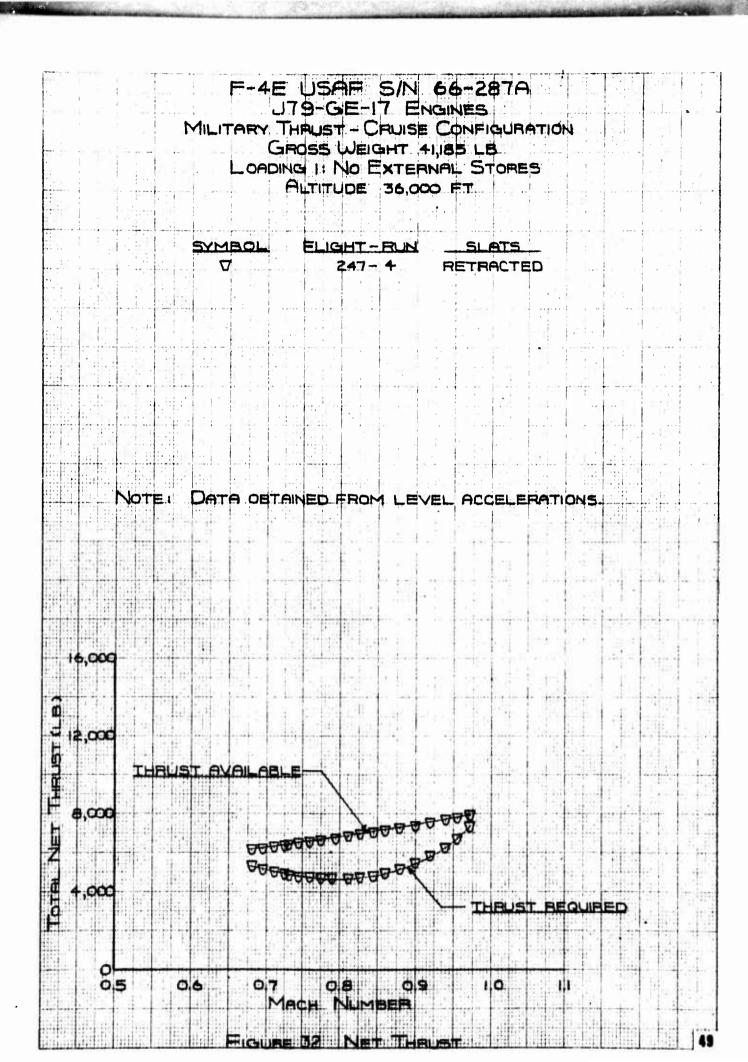


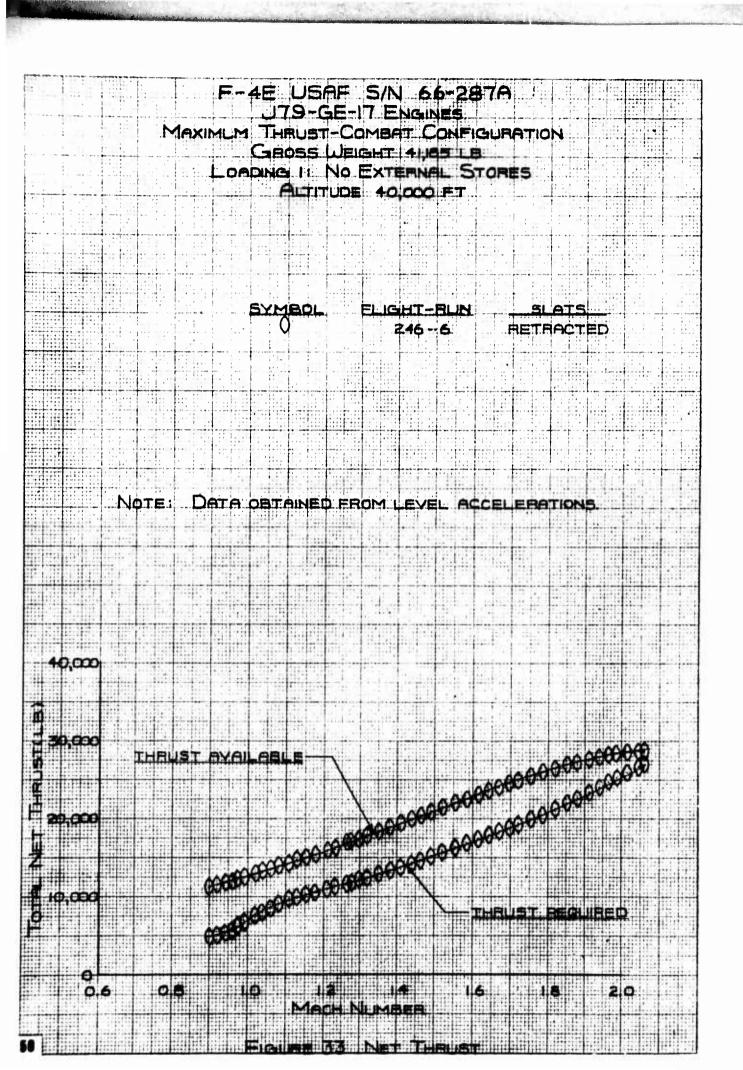


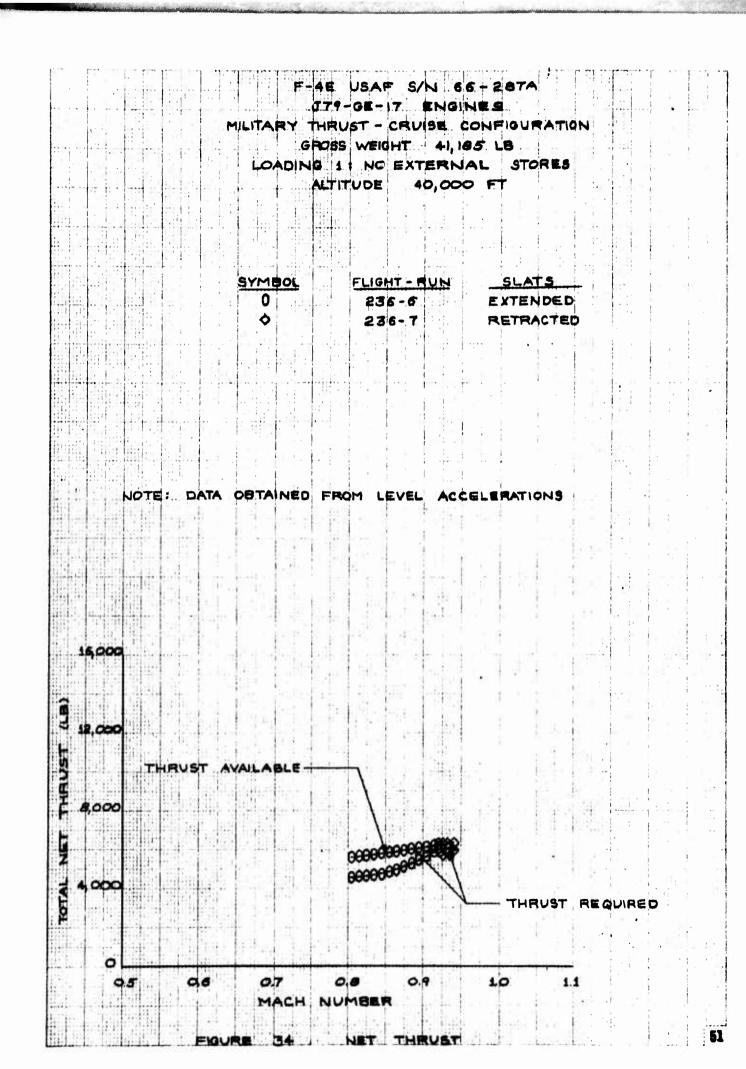
# F-4E USAF S/N 66-287A J79-GE-I7 ENGINES MAXIMUM THRUST-COMBAT CONFIGURATION GROSS WEIGHT 41,185 LB LOADING I: NO EXTERNAL STORES ALTITUDE 36,000 FT

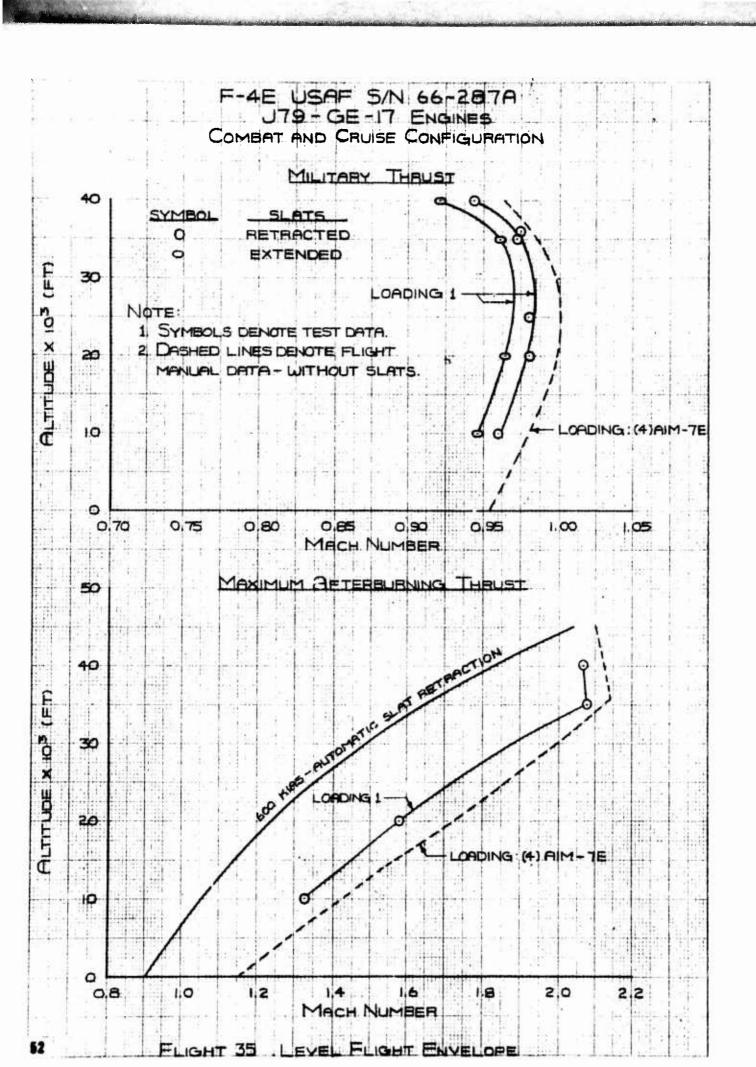


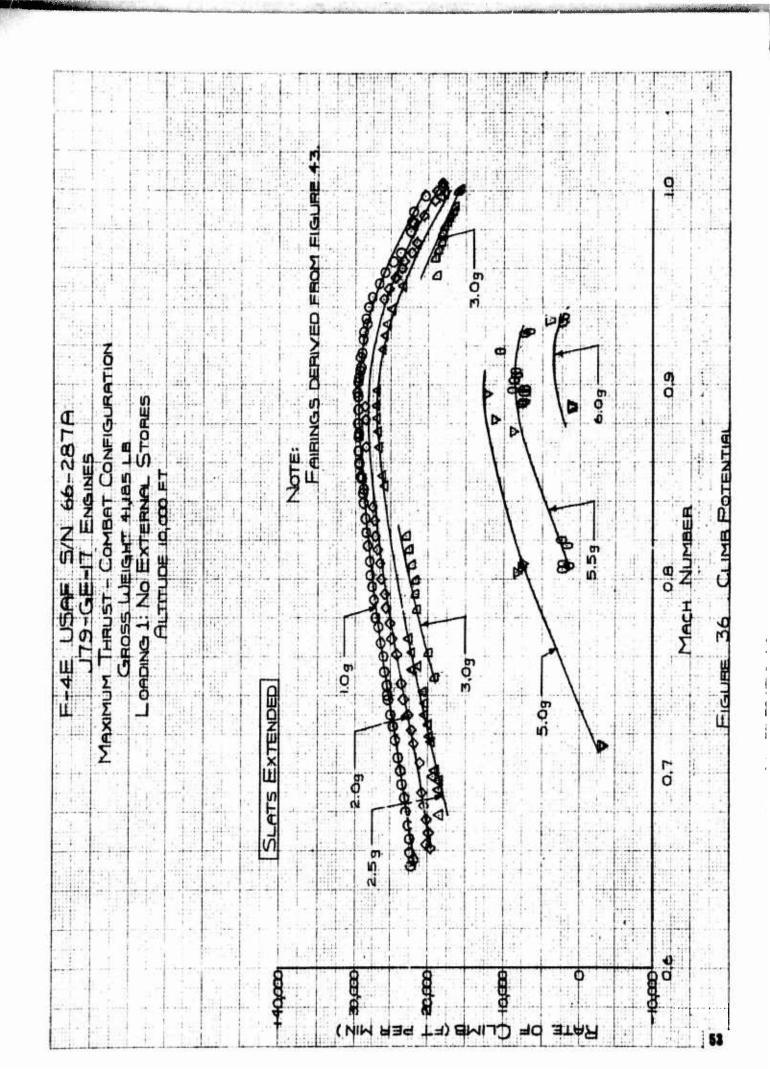


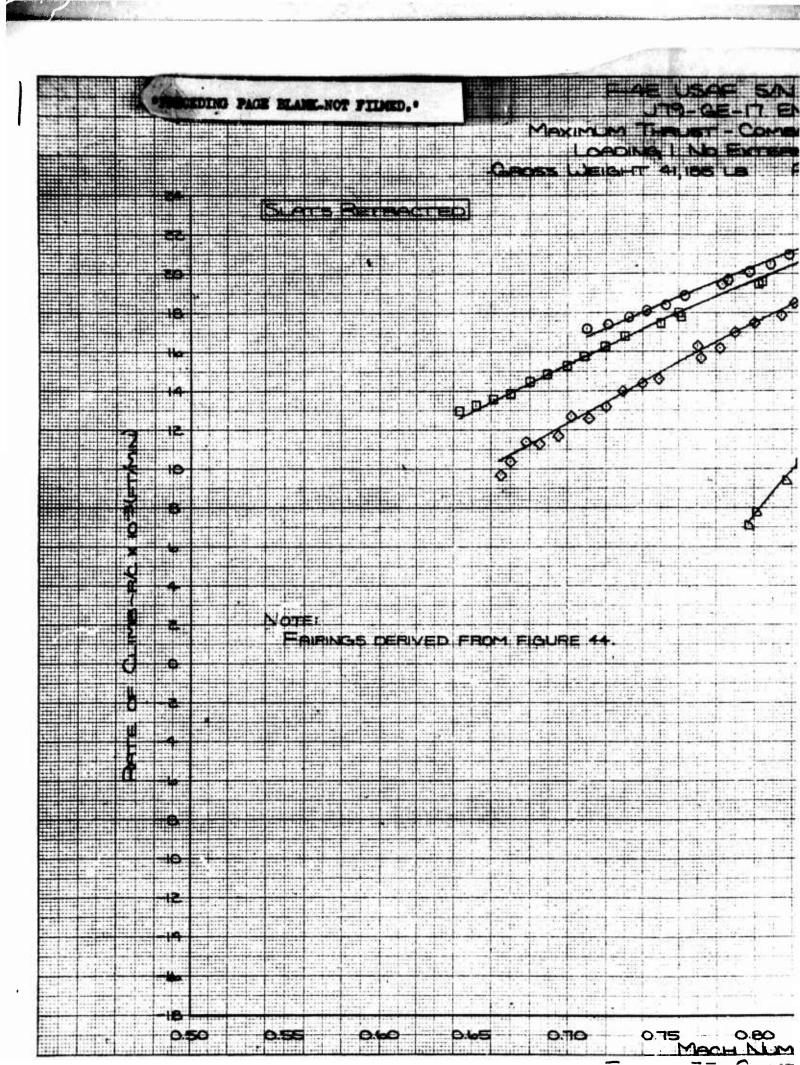


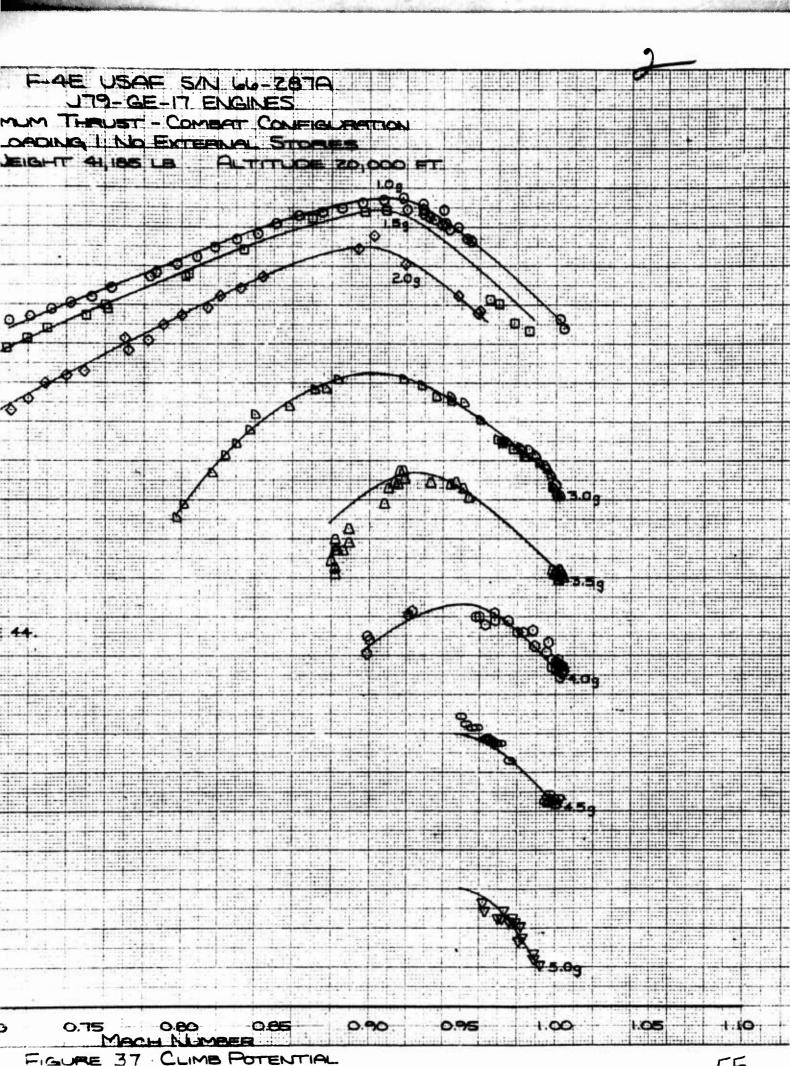


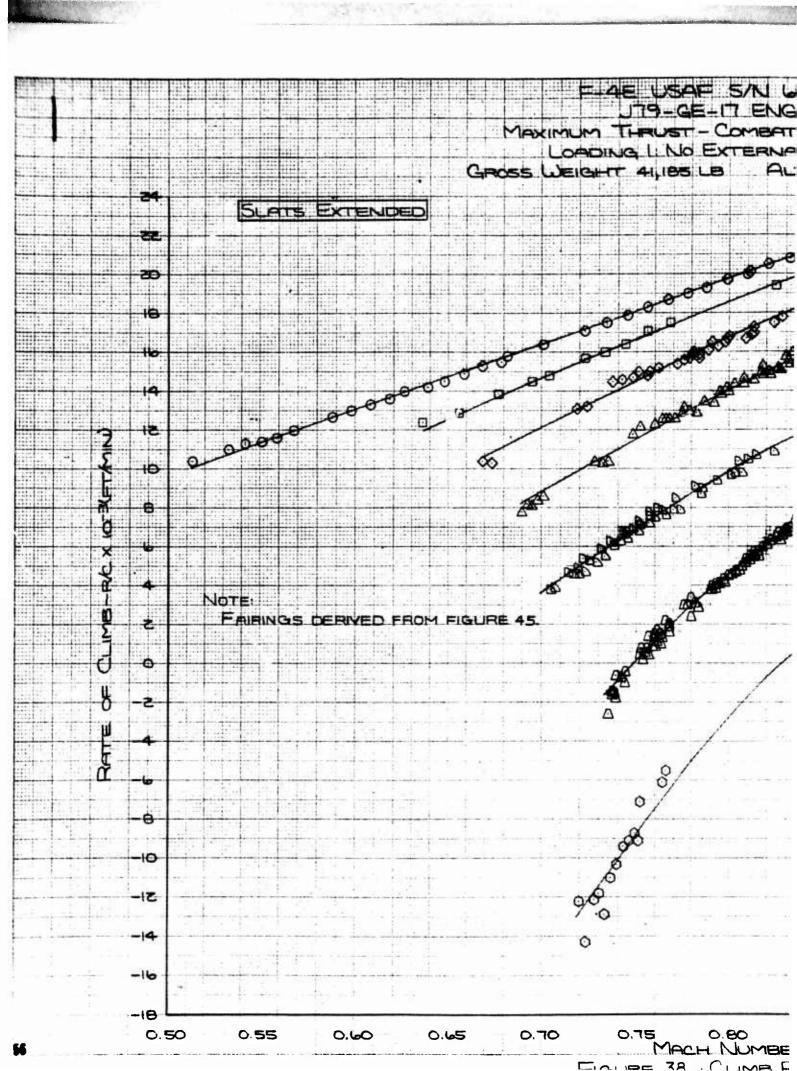


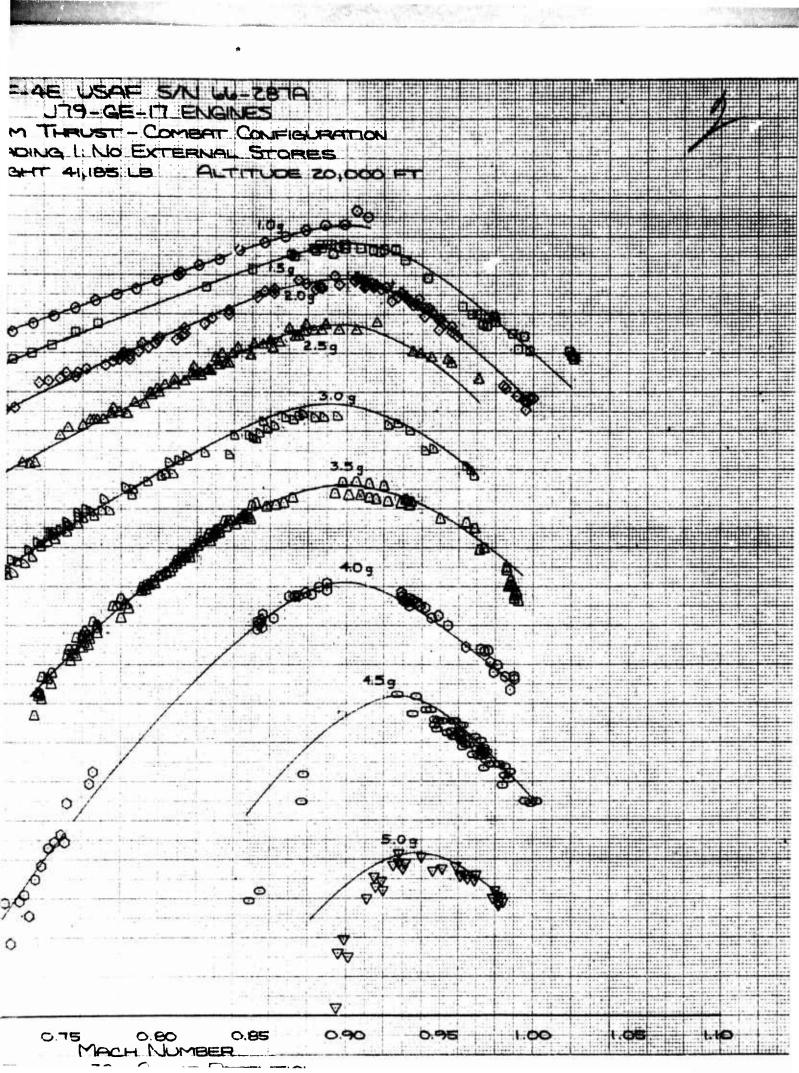


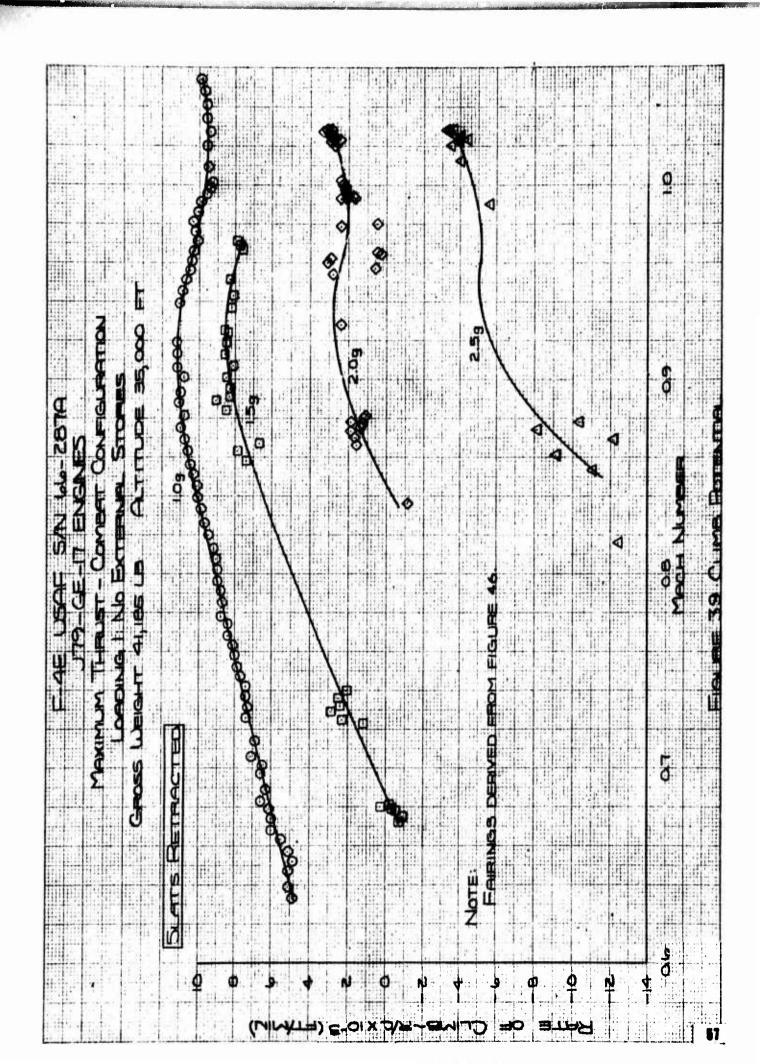


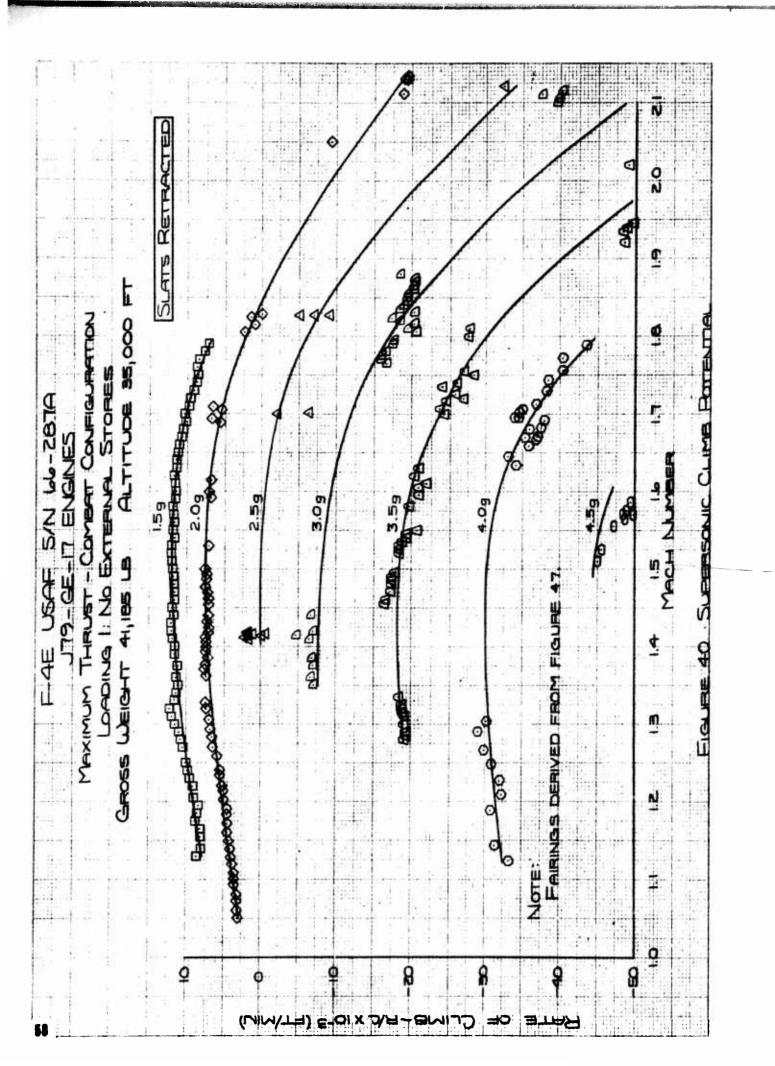


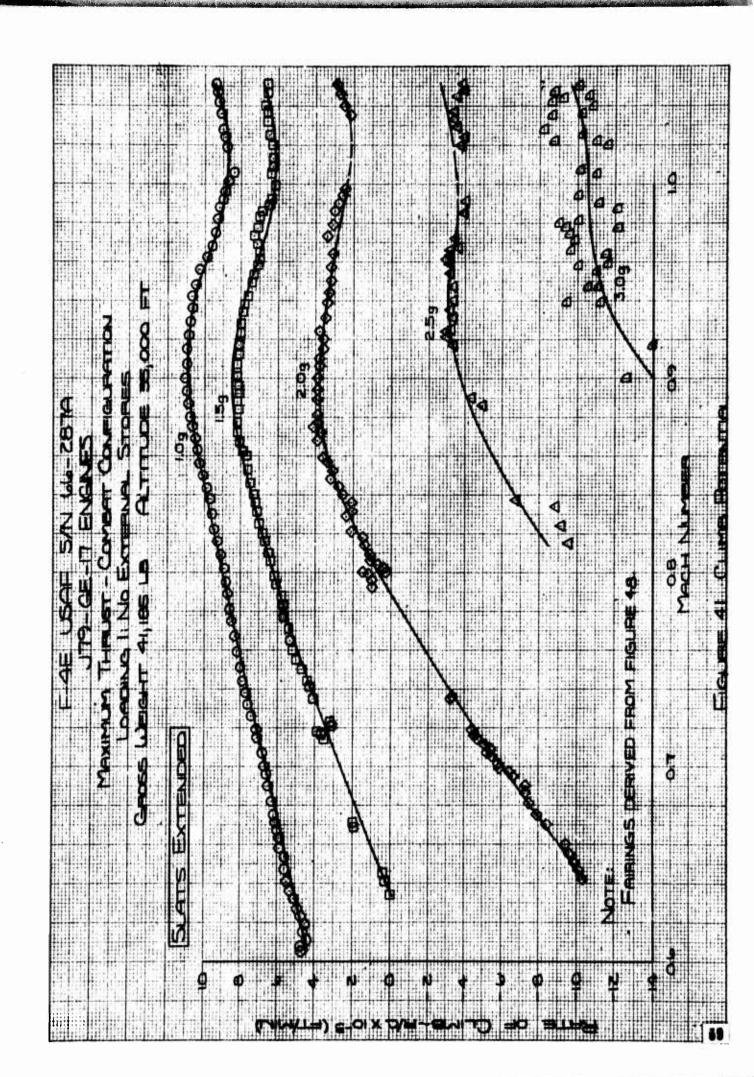




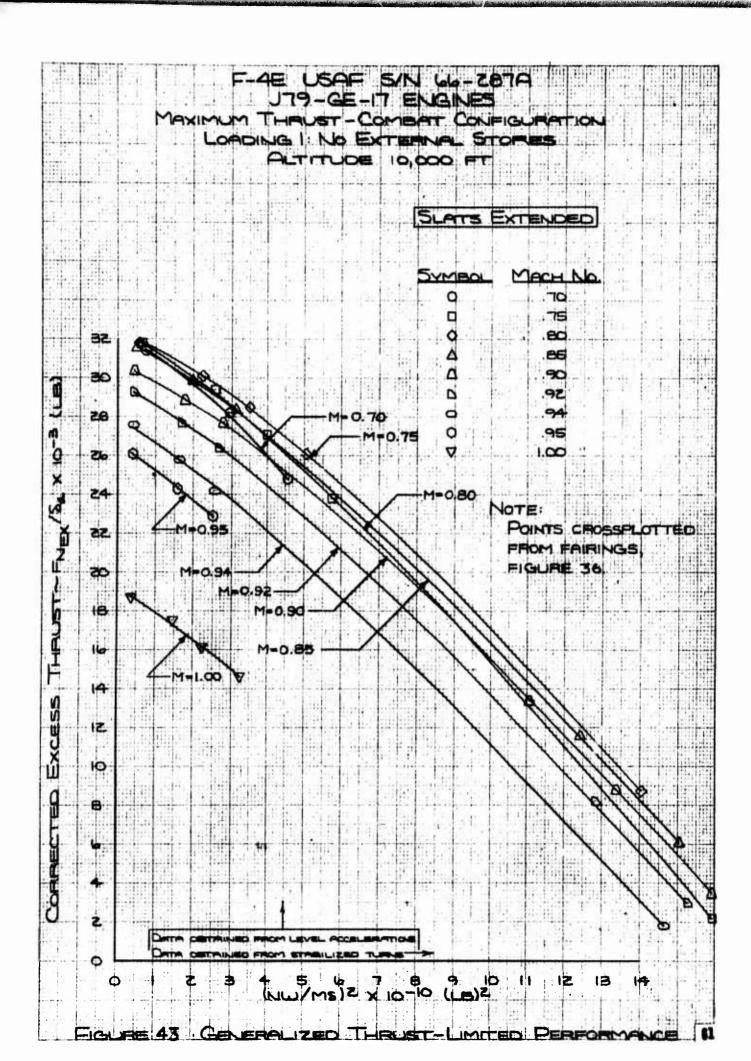






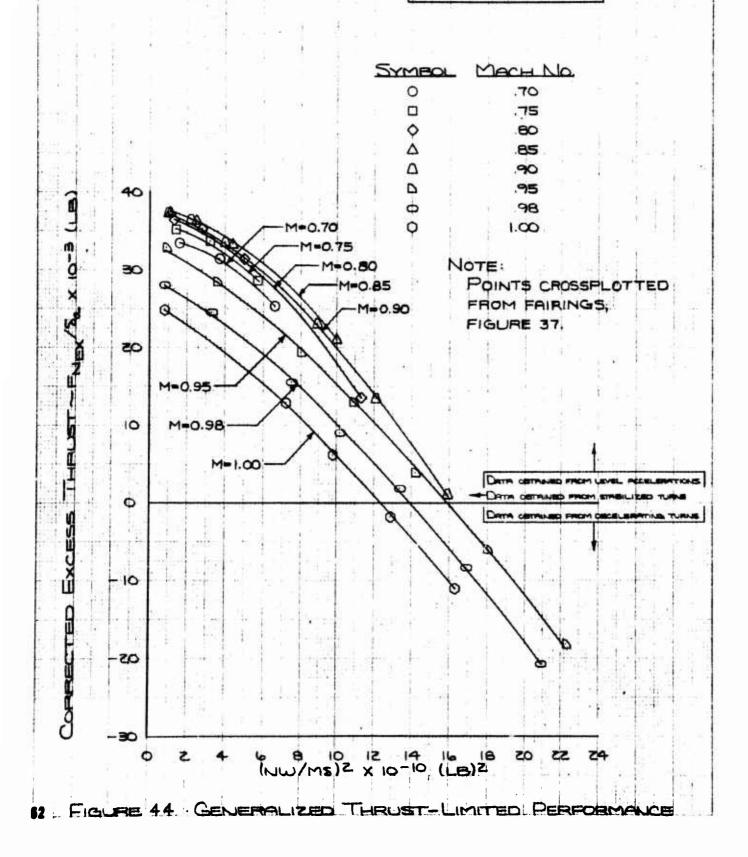


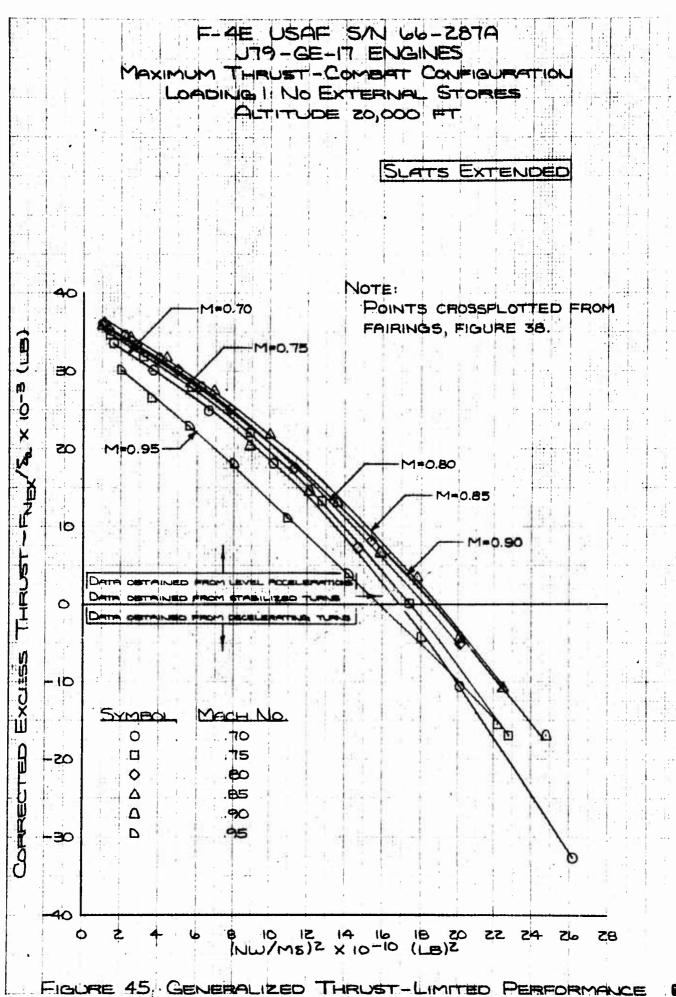
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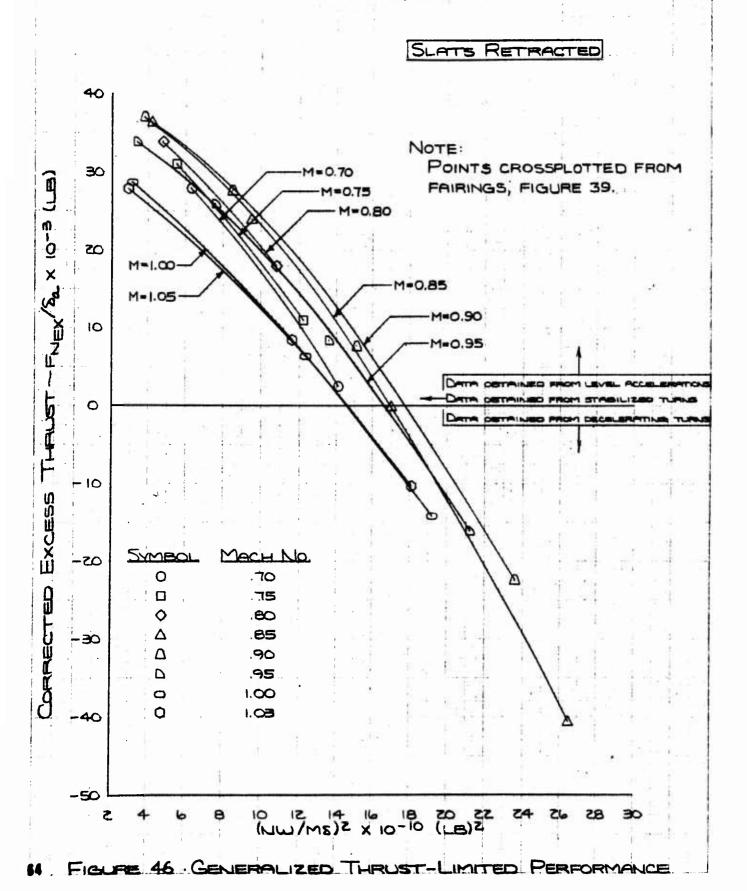
# F-4E USAF 5/N 66-287A J79-GE-17 ENGINES MAXIMUM THRUST-COMBAT CONFIGURATION LOADING 1: NO EXTERNAL STORES ALTITUDE 20,000 FT

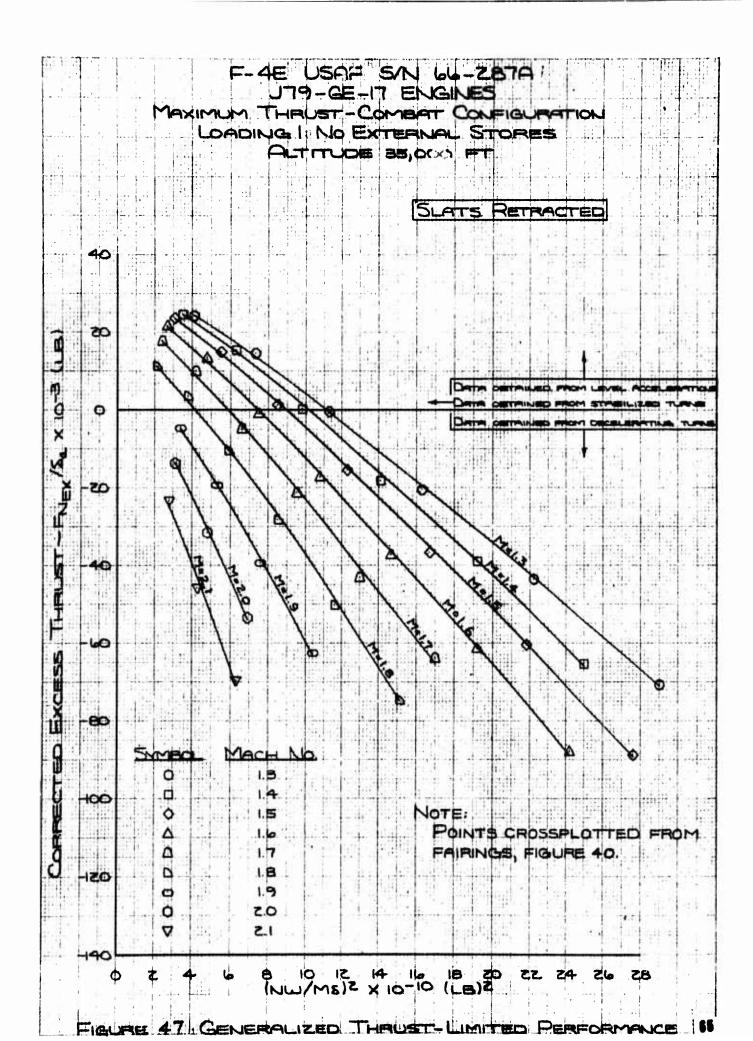
# SLATS RETRACTED

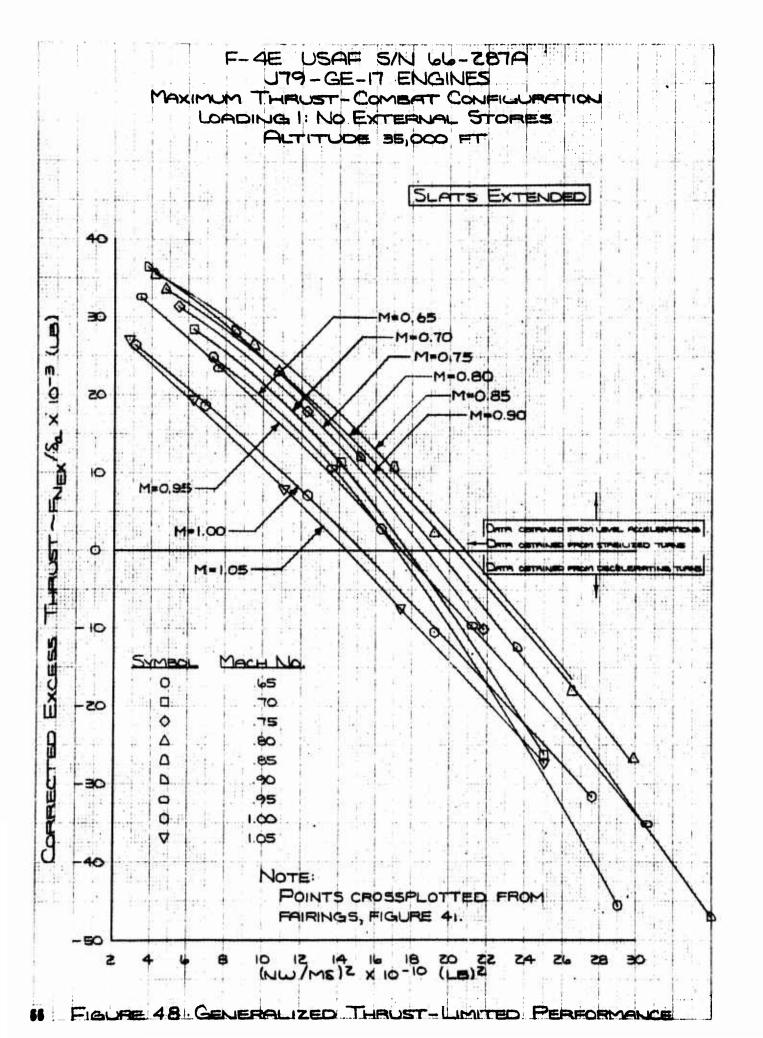


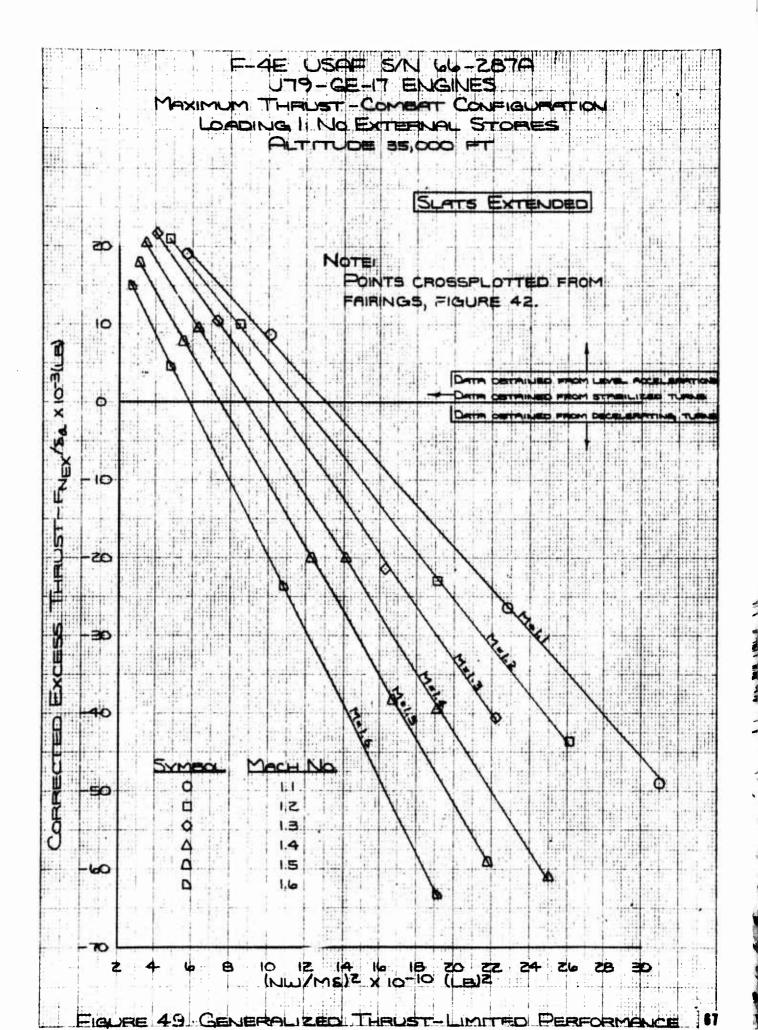


## F-4E USAF 5/N 66-287A J79-GE-17 ENGINES MAXIMUM THRUST-COMBAT CONFIGURATION LOADING 1: NO EXTERNAL STORES ALTITUDE 35,000 FT

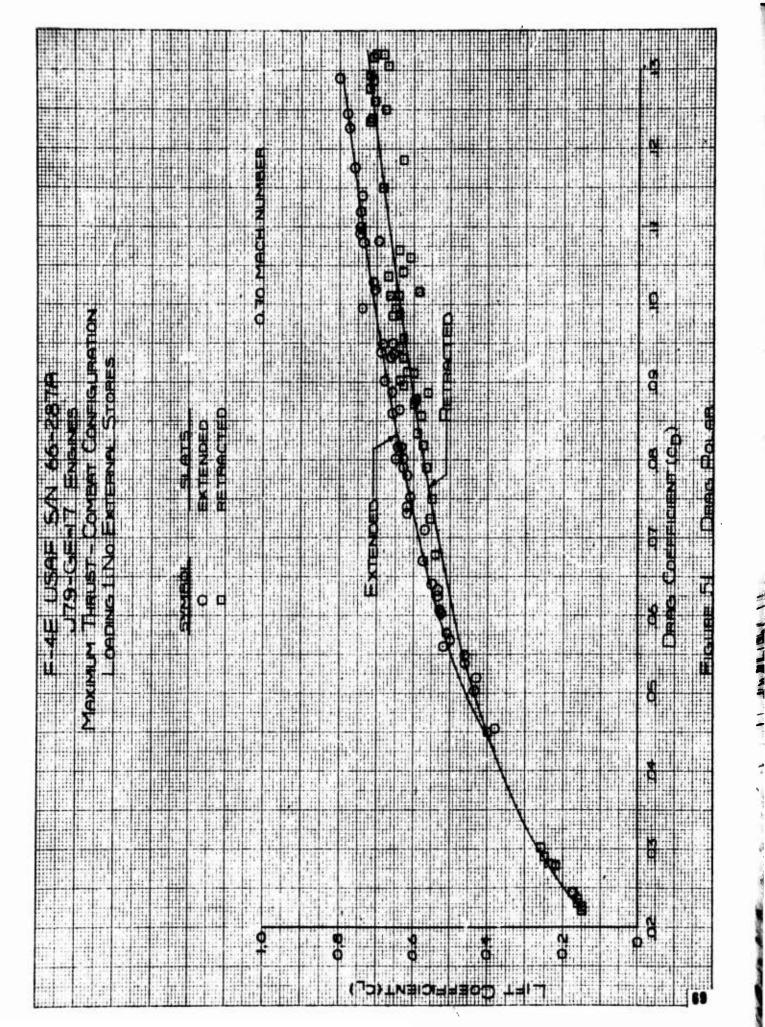


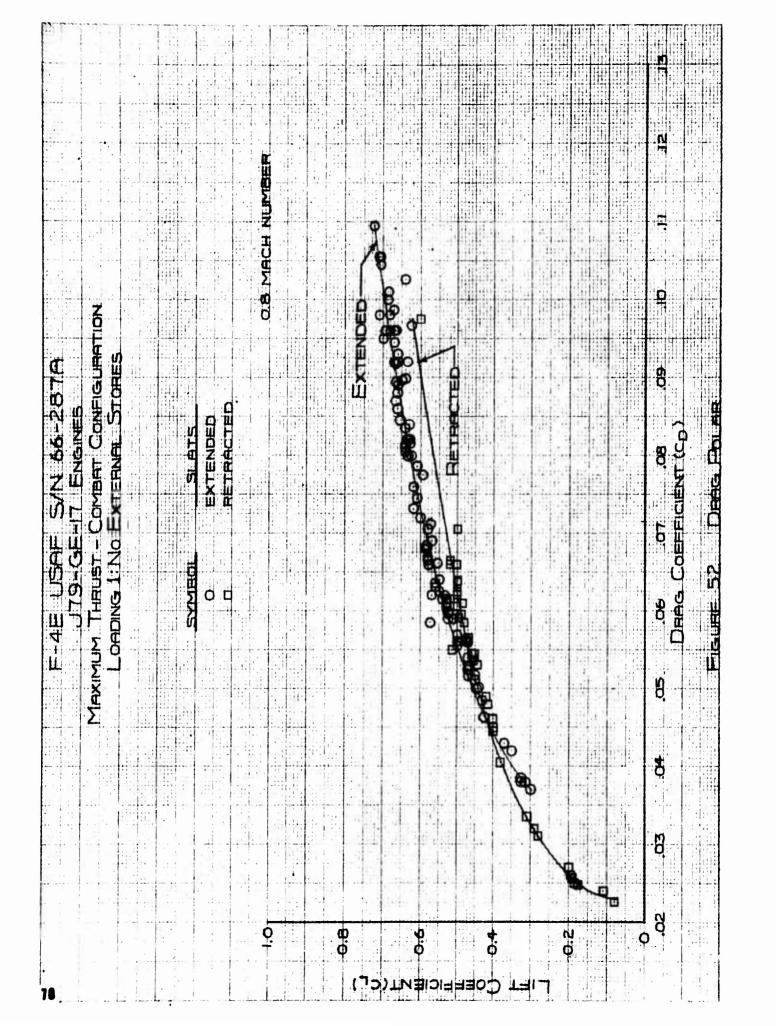


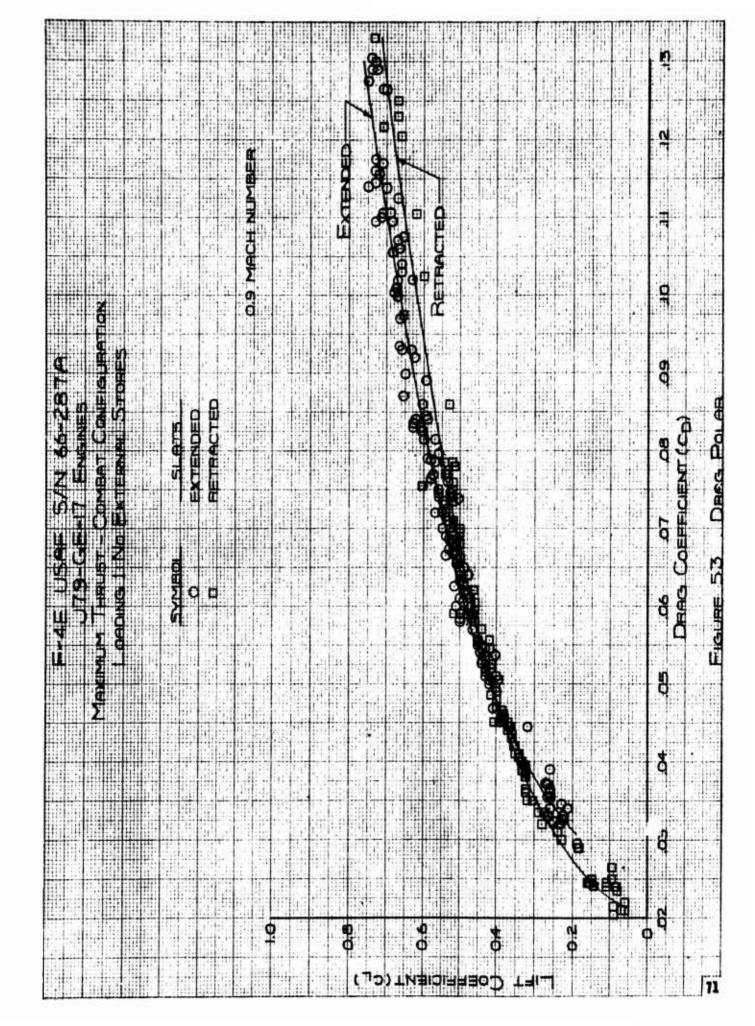


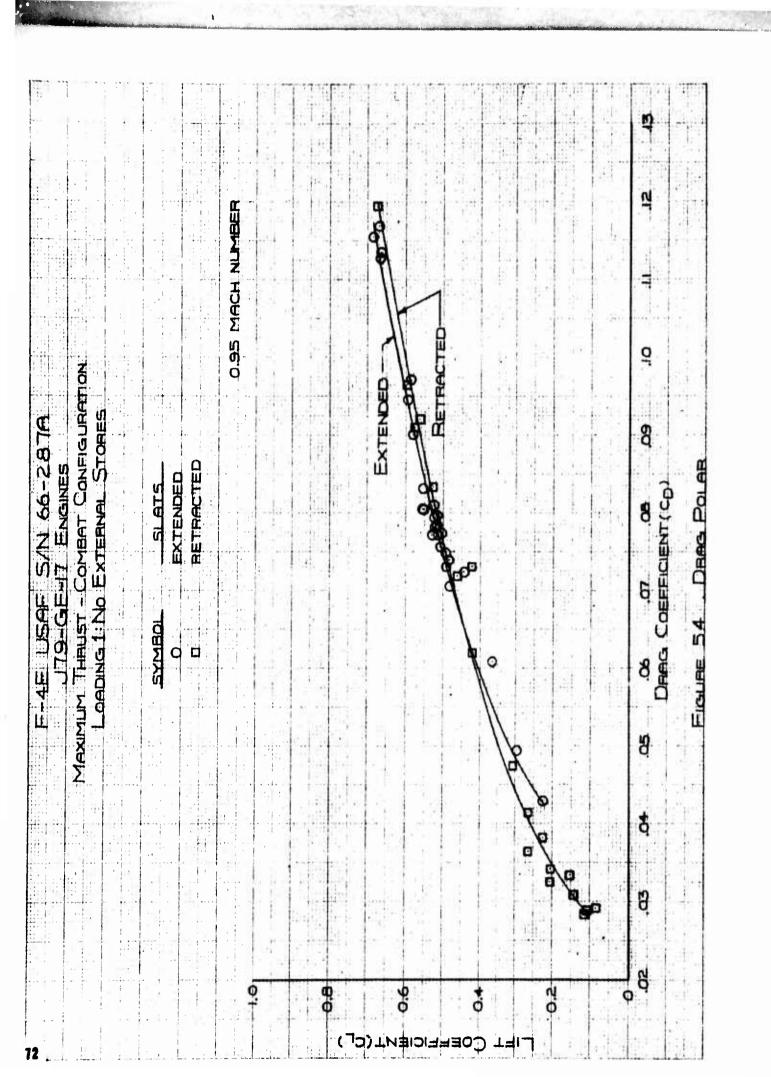


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T ENGINES	U	ANGE STORES	SLATS	EXTENDED	ÆTRACTED	EXTENDED	RETRACTED		Y II TEST DATA.	8   9   8				-10,000 FT	20,000 FT					4. 6.1	
379-GE-17 E		CAROSS WEIGHT 41.18	BOL ALTIUDE(ET)	0000	30,000	000' <del>E</del>	<b>8</b> 80 80 80		ES F-4E CATEGOR			•	\ \ \ \		7		4			1,0 1.2 Mach Number	
	ş		SYMB	0 0		4		Notes	L DASHED LINE DENOT				BOWNET C			1/4		35.000		9.0 - 9.8	
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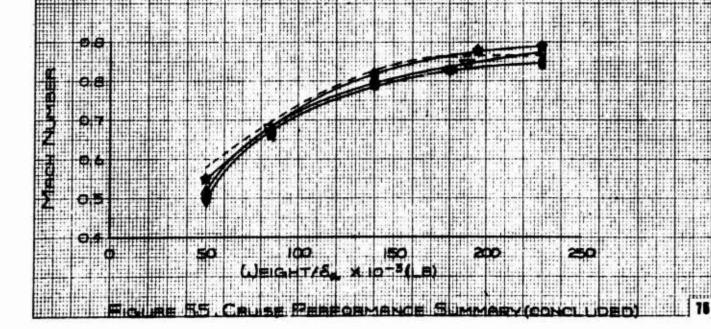


	J79	JSAF S/N 9-GE-17 UISE CONFIG	ENG NES		
SXMBOI	ALTITUDE(ET) 5,000 21,000	GROSS WEIGHT(LB) 40,500 37,300	₩/6 LOAD 50,000 I 85,000 I	NG SLATS RETRACTE RETRACTE	1
	30,000 37,600 41,300 7,000 22,000	39,300 40,300 37,500 36,700	10,000 30,000 50,000 85,000	RETRACTE RETRACTE RETRACTE EXTENDED EXTENDED EXTENDED	
	31,000 38,000 42,000	37,600		EXTENDED	
	Note: I Ofen sy	MBOLS DEN	TE SLATS R		
	2 50LD 51 3. DASHED	MBOLS DEN LINE DENOTE FERENCE &	OTE SLATS E S RESULTS C	XTENDED FF-4E CAT II	
				<b>-</b>	
14 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5					
# 1,500	50 (6 WEIGH	o 150 T/8 <sub>4</sub> × 10 <sup>-3</sup>	200	250	

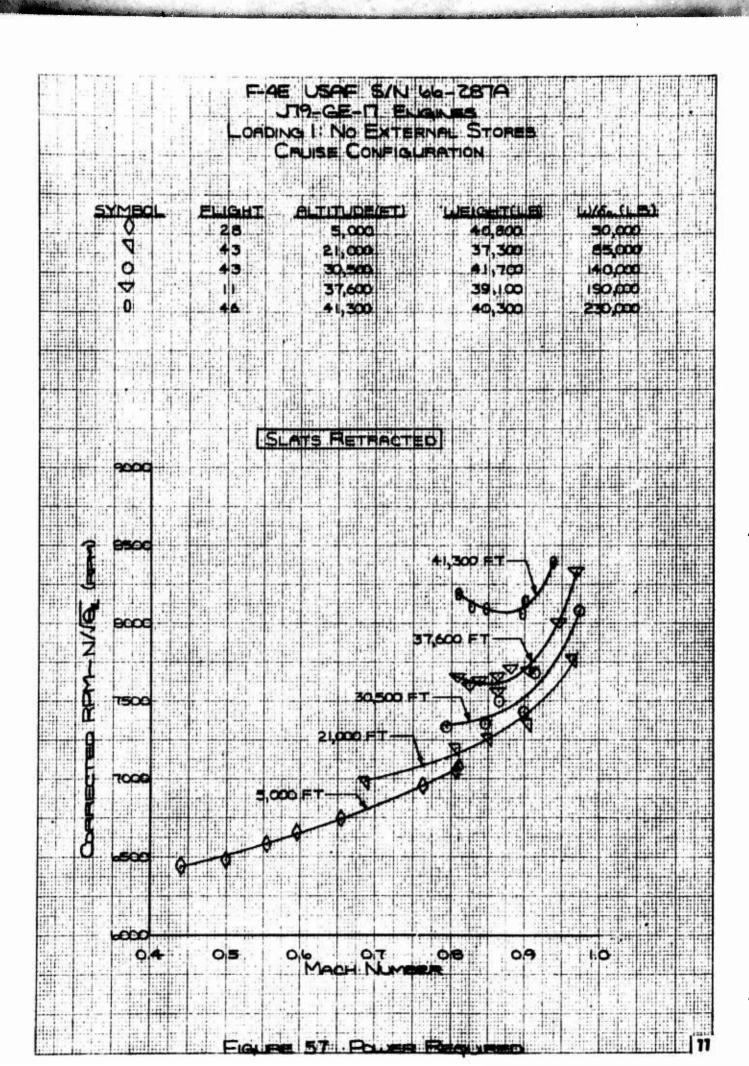
#### 5/N 66-28 CRUISE CONFIGURA TION

	le l'illedéands	GROSS		<b>Hill H</b> ill Hill Hill Hill Hill Hill Hill	
SYMBOL AL	CITUDECETO	WEIGHTOLE)	LIVE L	OPDING	SLATS
	5,000	40,800	50,000	Li. <b>L</b> l.: 1	RETRACTED
THE THE	21,000	37,300	85,000		RETRACTED
i i a i i	30,000	41,700	140,000	1 . is	RETRACTED
<b>4</b>	37,600	39,300	190,000		RETRACTED
0	41,300	40,300	230,000		RETRACTED
	7.000	37,500	50,000		EXTENDED
	22,000	36,700	85000		EXTENDED
	31,000	40,100	140,000		EXTENDED
	38,000	37.600	180.000		EXTENDED
	42,000	36,460	230000		EXTENDED

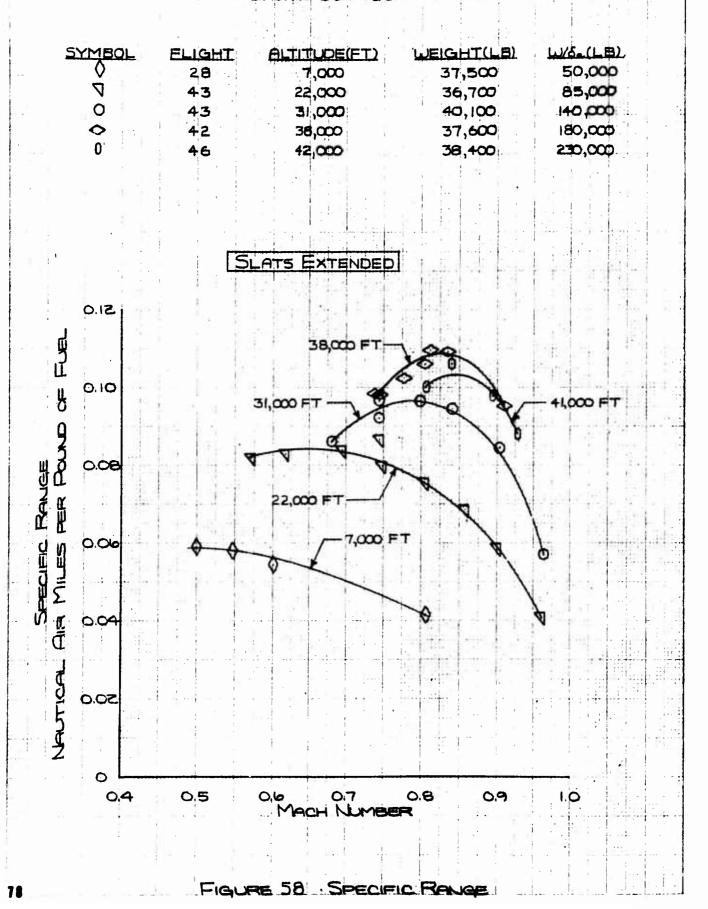
- NOTE: L'OPEN SYMBOLS DENOTE SLATS I 2 Salid Symbols DENOTE SLATS 3 DASHED LINE DENOTES RESULTS 2 3 TEST CHEFERENCE
  - FLIGHT MANUAL DATA



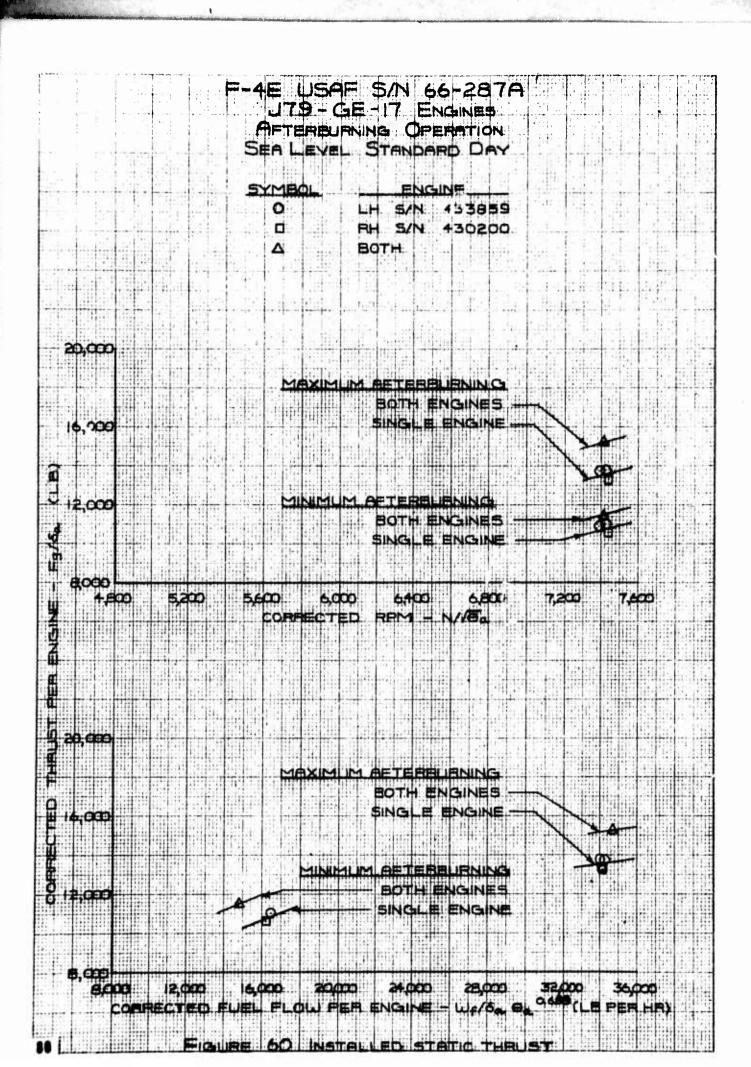
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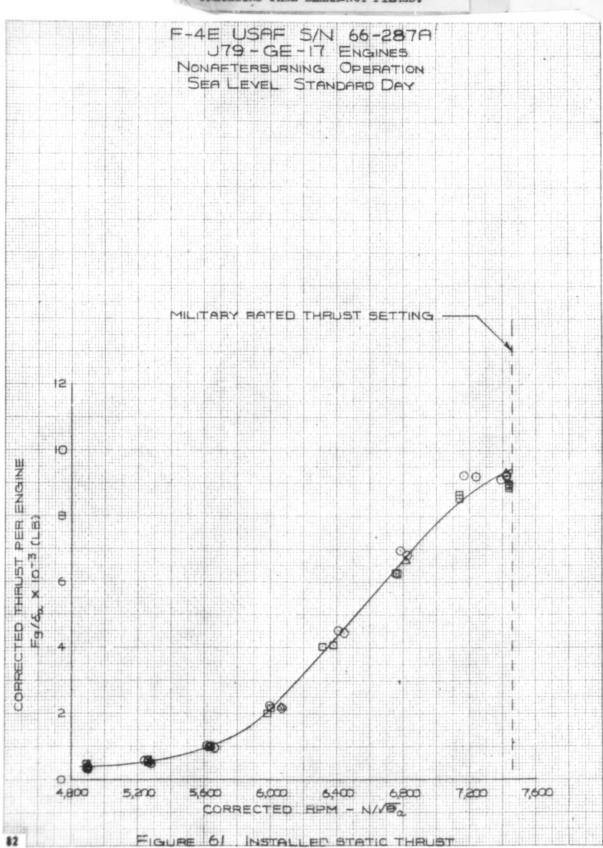


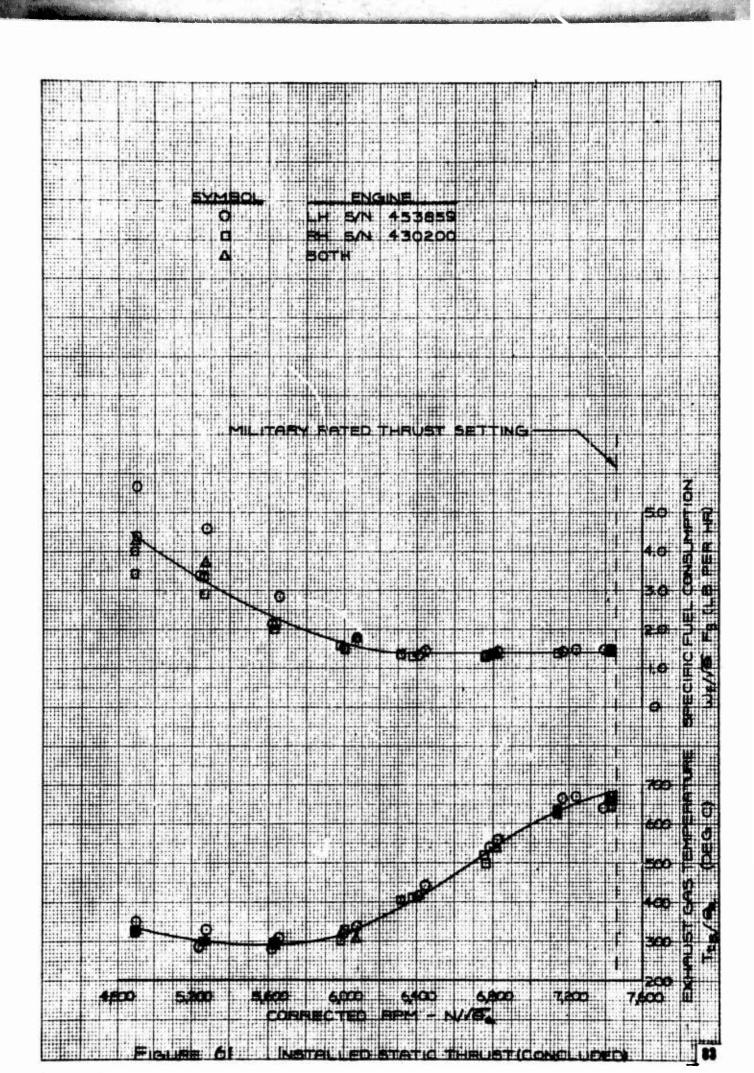
# F-4E USAF S/N 66-287A J79-GE-17 ENGINES LOADING I: NO EXTERNAL STORES CRUISE CONFIGURATION



			E USAF 5/N		
		Cepin	179-GE-17 ENG	NES STORES	
			RUISE CONFIGU	RATION	
SY	MBOL	ELIGHT	ALTITUDE(FT)	WEIGHT(LB)	い(名。(上日)
	7	28 43	7,000	37,500	50,000 85,000
	0	43	31,000	40,100	140,000
	0	42	38,000 42,000	37,600 38,400	230,000
		SI	ATS EXTENDED		
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	77				1 1
3	<del>25</del> 00				
			41	,000 FT-	G
ď				9	<b>A</b>
137	eccc		38,000 FT-	1000	
1			0	100	
Ì.	7500		51,000 FT	000	
T.			1 010	4	
1		22,00	OFT V	<b>3</b>	
N N	1000		10 1		
-		7,000 FT-	10		
8.	.50C	00			
	0.4	0.5	05 07	0,8 0,9	
	U,- <b>-</b>		MACH NUMBE		
			= 59 Power		

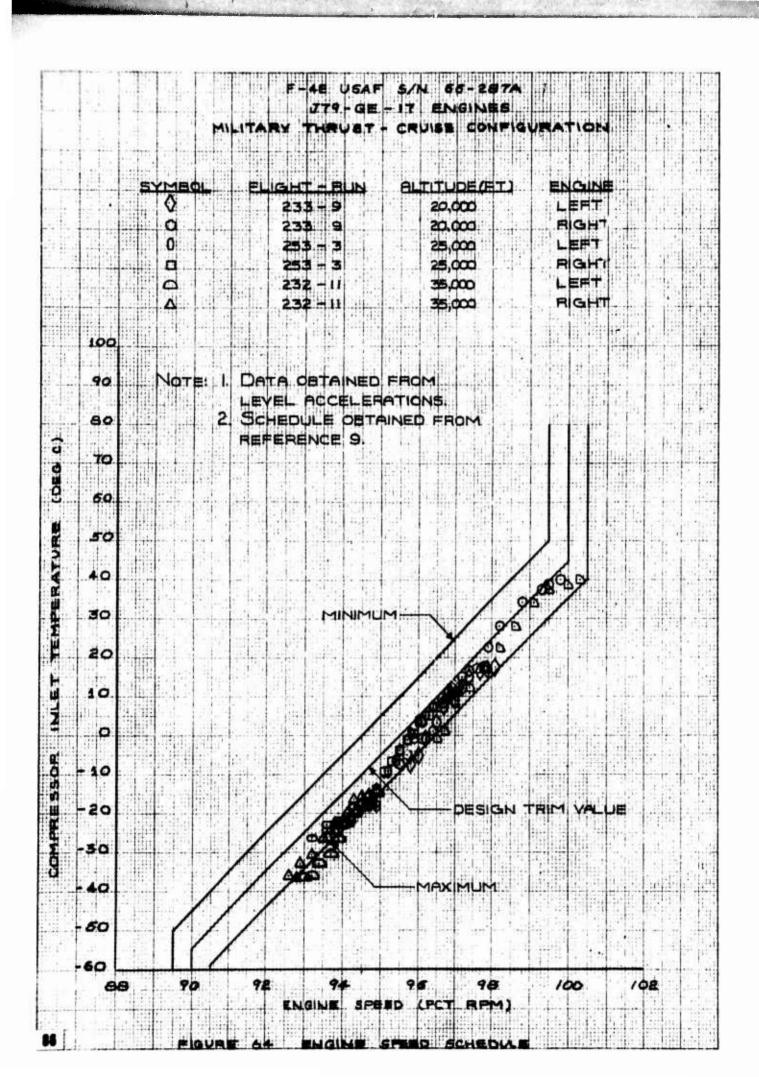






		\$	OMEAT CONFIGU	MATION	
	SYMBOL			ENGINE	
		282 - 3	10,000	L LEFT	
	Š	<b>53</b>	10.000 2.000	RIGHT	
			<b>4</b>		
	Ğ	246 - 6			
		246 - 6	#3,F#C	RGHT	
100	Note	DATA DETAINE	RATIONS.	1 86	
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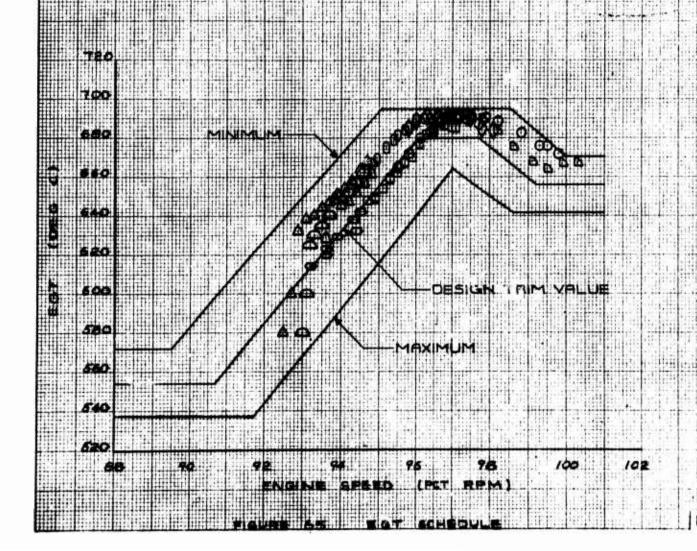
		<b>MAXIM</b>			eun Atton	
	5¥250 6 8		31-T - Rus 282 - 3 282 - 3 287 - 5	600000 10,0000 10,0000 20,0000	ENGINE LEFT ROLL CEFT	
	000		247 - 5 246 - 5 246 - 6	40,688 40,688	MGHT LEFT RIGHT	
	Nort		TA DETANEL HEDULE OBT	FROM LEVEL A	CCELERATIO ERENCE 9.	<b>N</b> 5.
72.0 790		MINIM				
650 645 8			000			
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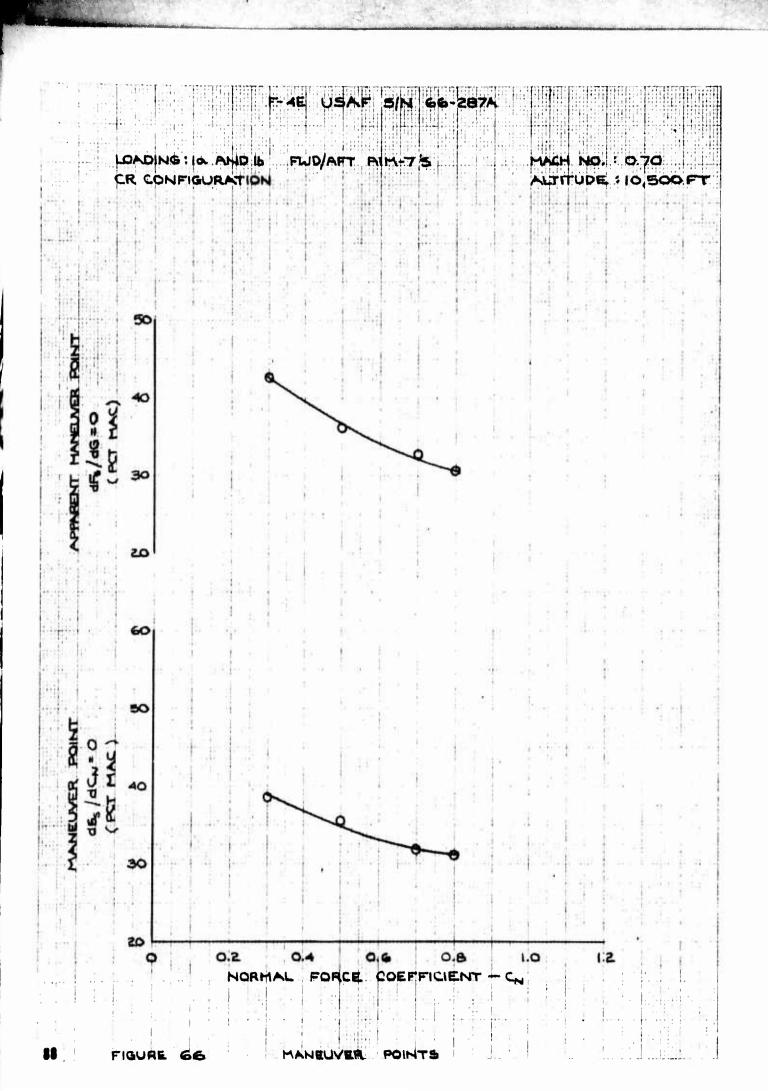


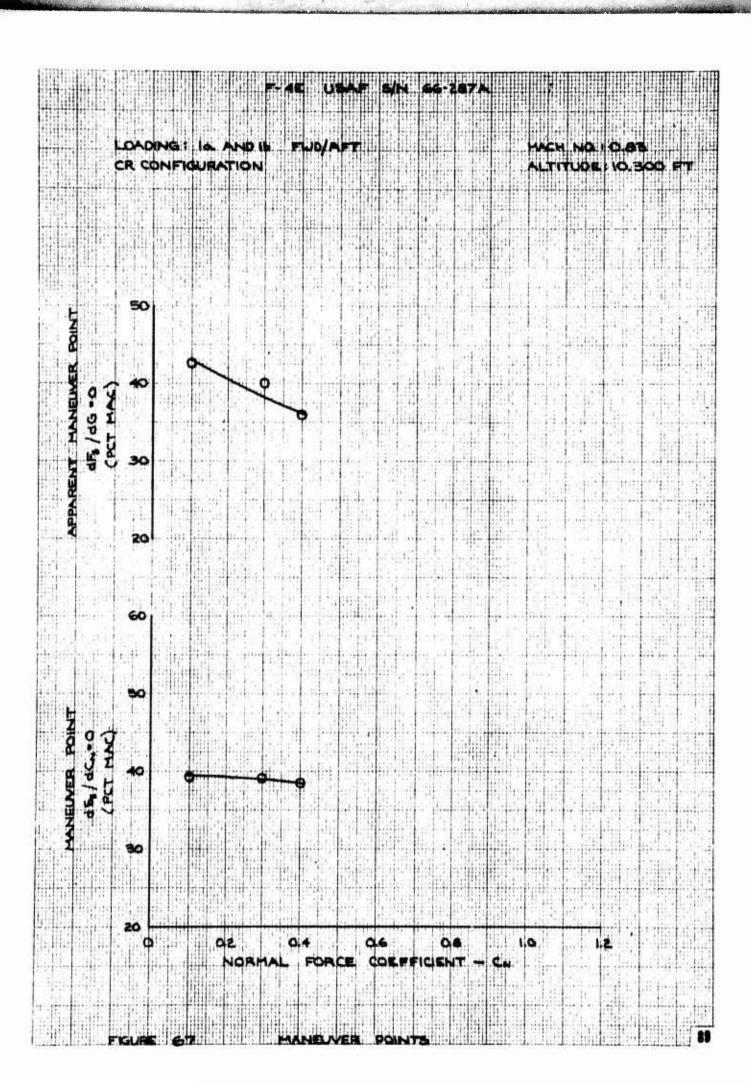
### F-ME USAF SN 66-287A 577-98-17 ENGINES MILITARY THRUST - CRUISE CONFIGURATION

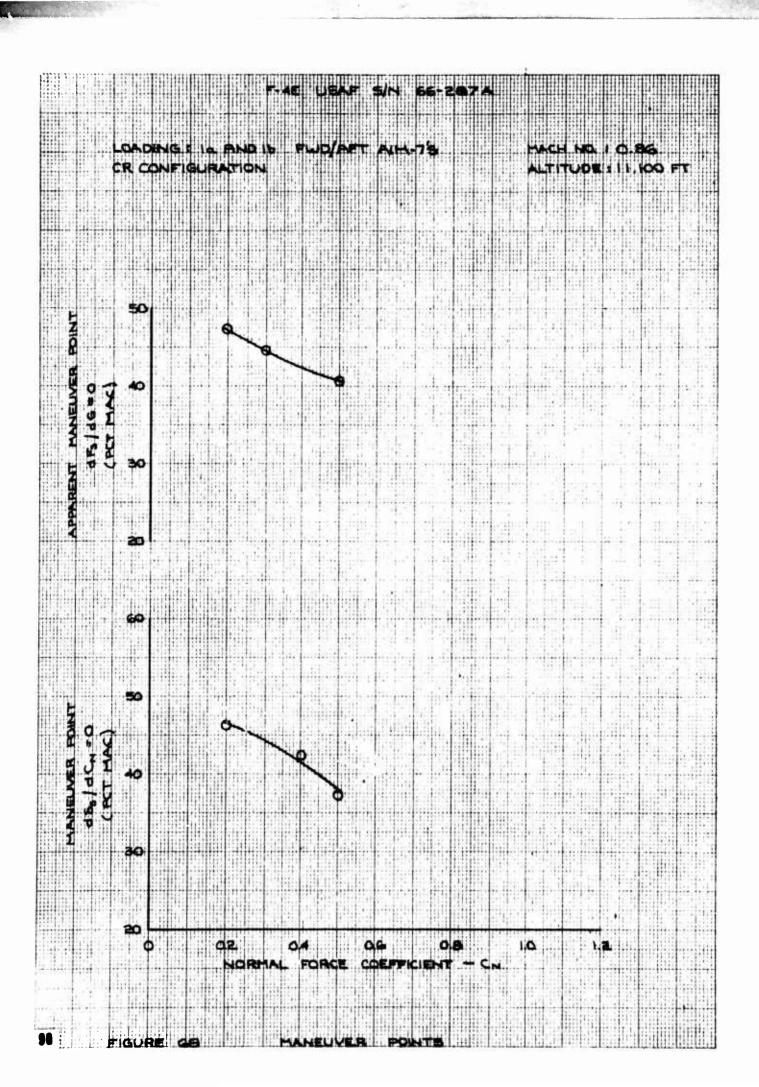
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la.	814	*14	614	444	***			4404	100	111	199	445	40.4	***	100	450		6 8 9	114	444	13.83	11.	4-4	414	26.	6444	40.0	1574	150	10.00	420	200	19.94	1100	COLUMN TO	100	125.00	23.54	241	6434	111	а
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100	840	111	10.1	ш	211	111	24	1174		900	227	и.	210	400	16.8			111	140	18.	10.00	7.44	144	44.99	444	41.	100	1000	411	111	<b>安全人</b>	2414	6-100	4.6	44.4	40.00	+ -	Park S	- 14	1461	1.1	ă.
114	200	111	* 1.5	-41	110	444	11	12.04	3		114	ы.	491	841	124	4.00		1.0	8.40		11.11	110	+++		141	1111	111	40		~	-	14.4	0.6	HILL	14.0	20.0		-	-		+++1	
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VOTE: I. DATA OBTAINED FROM LEVEL ACCELERATIONS.
2. SCHEDULE OBTAINED FROM REFERENCE 3.

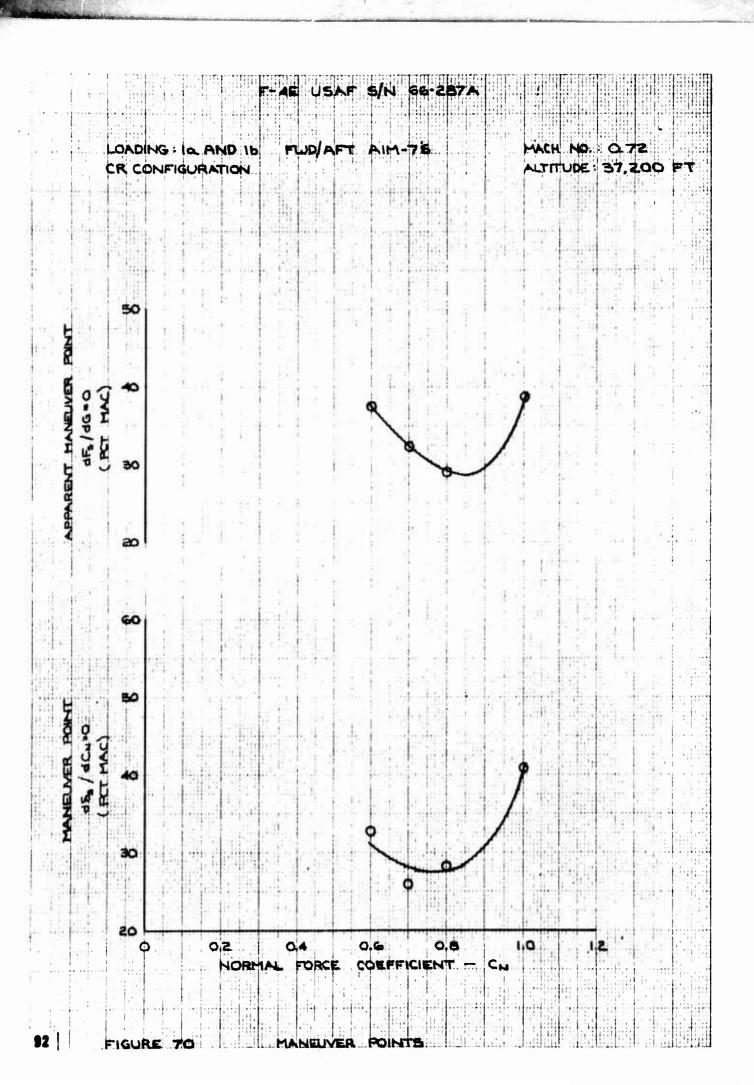


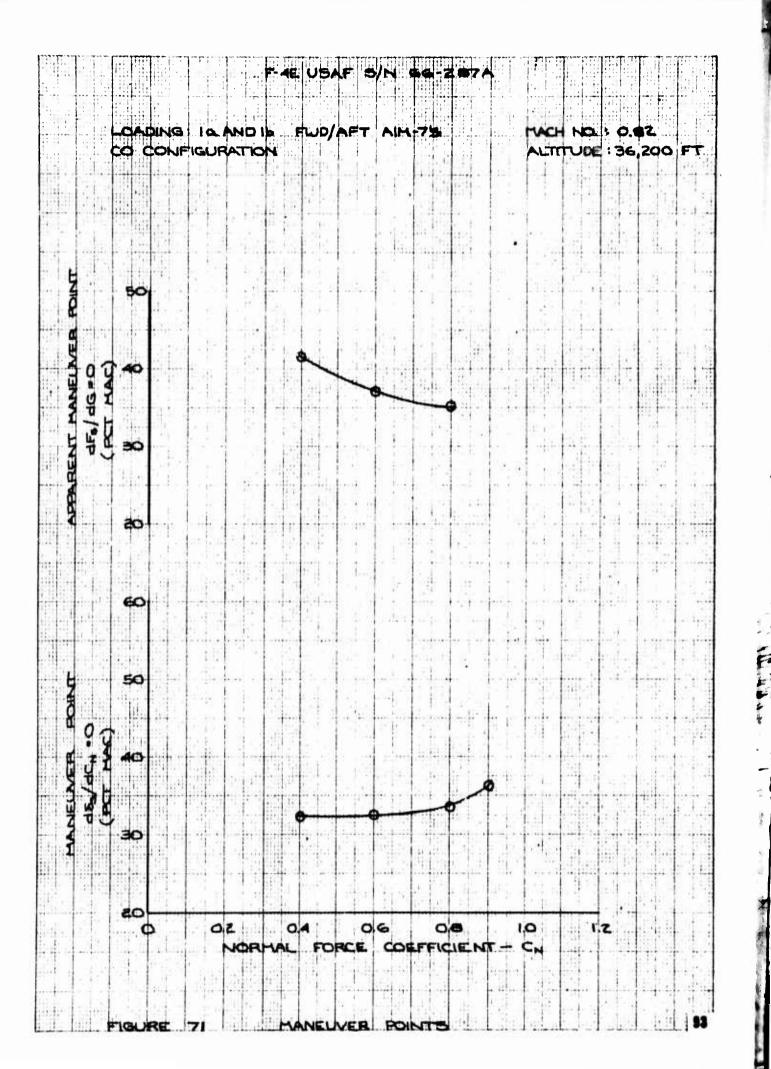


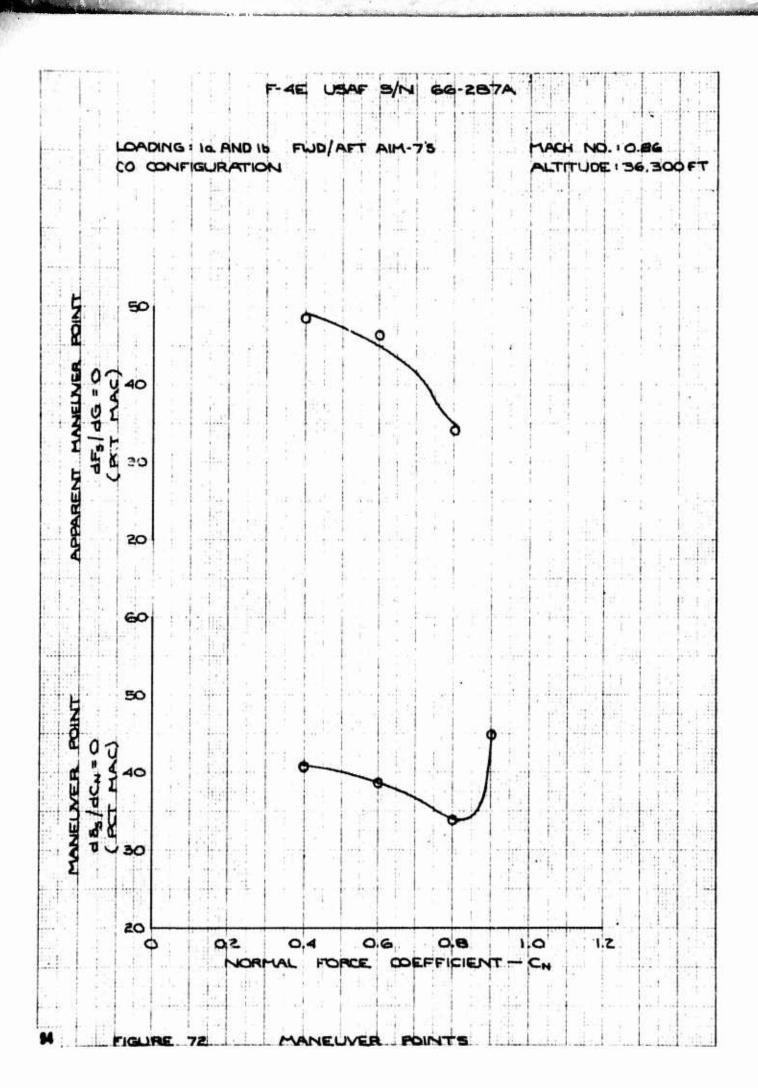


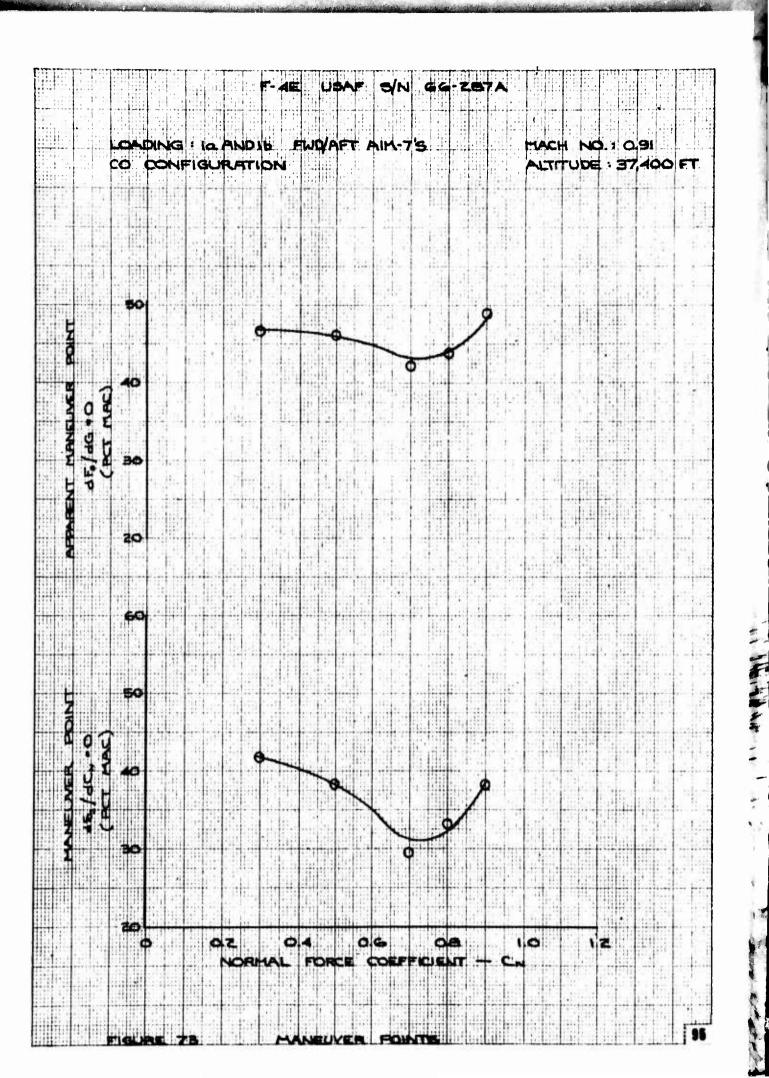


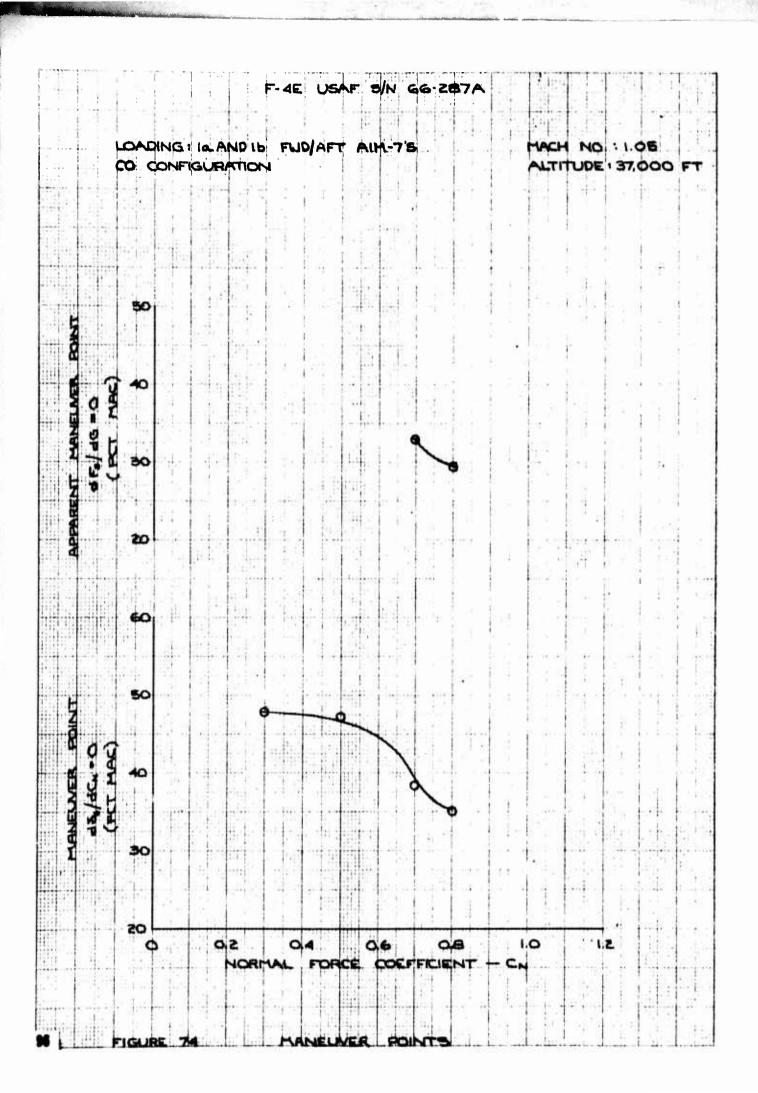
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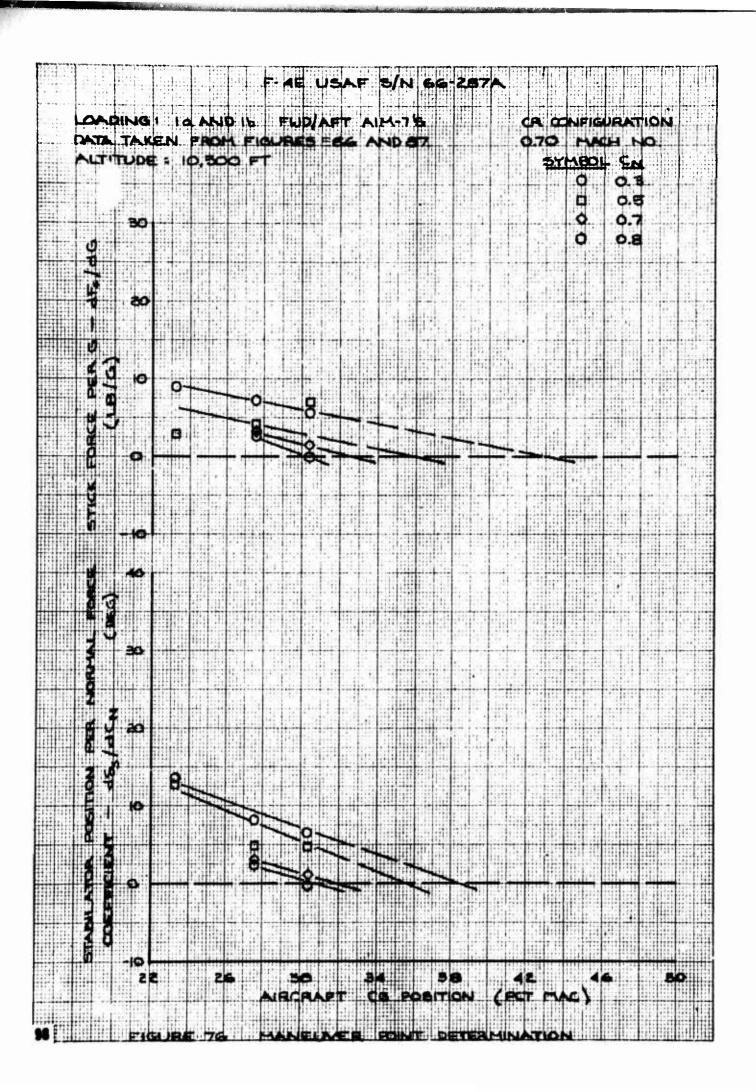


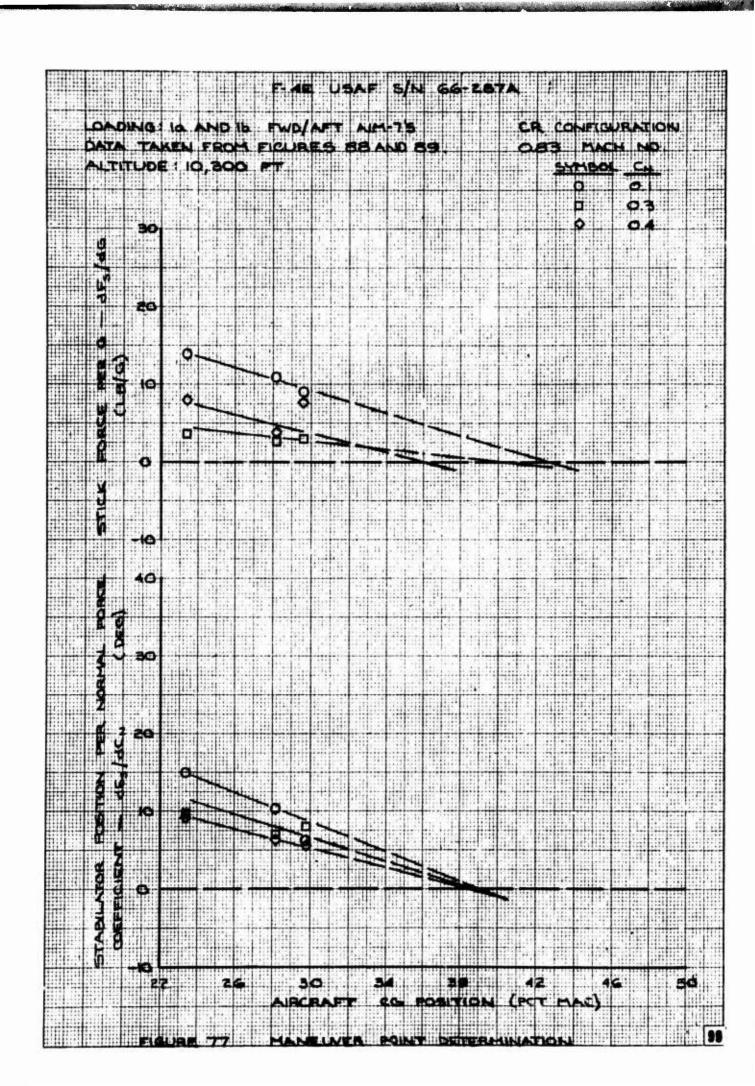


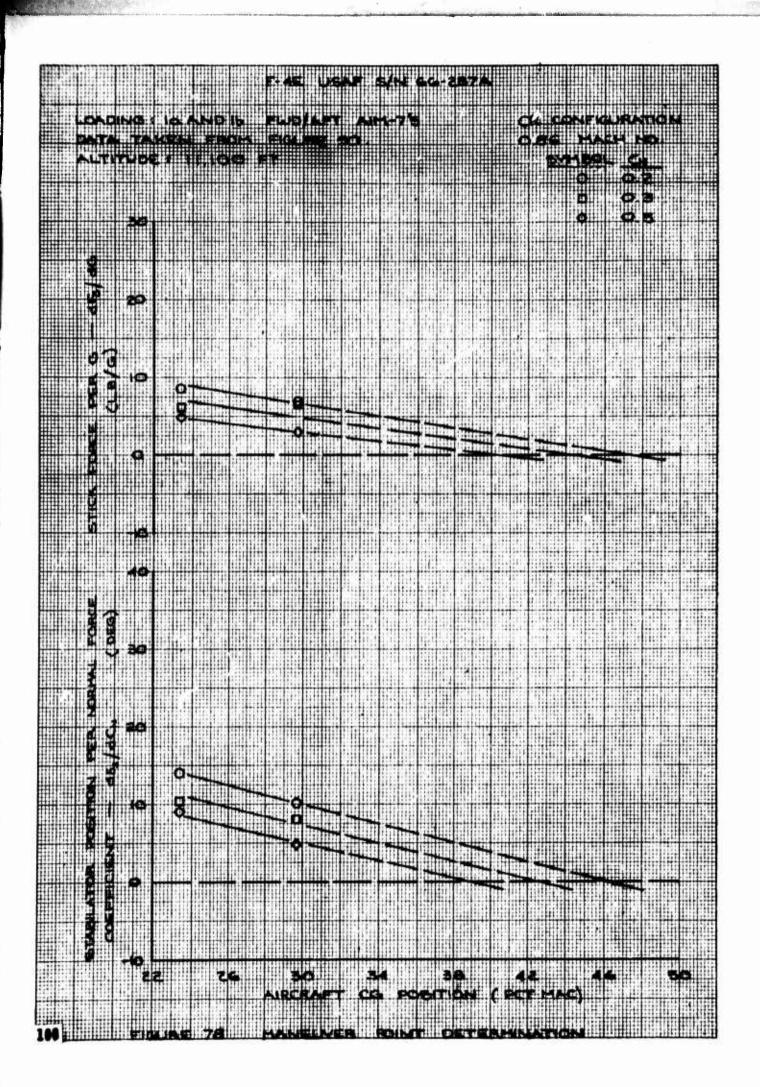


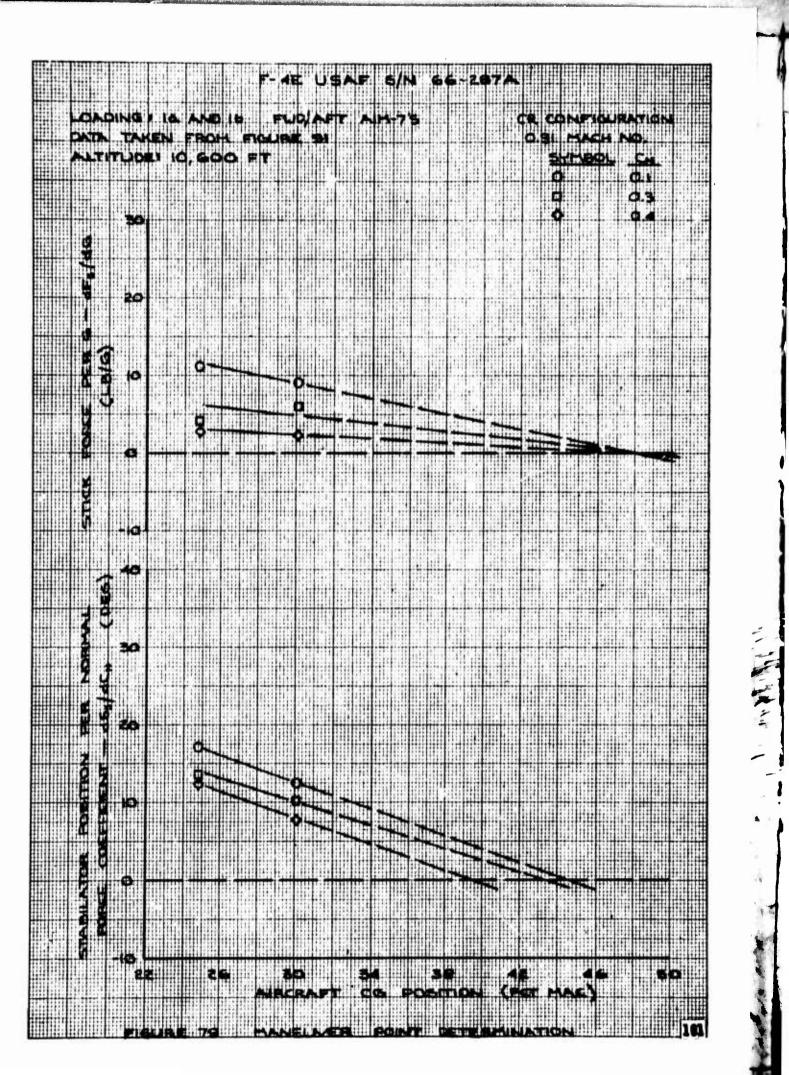


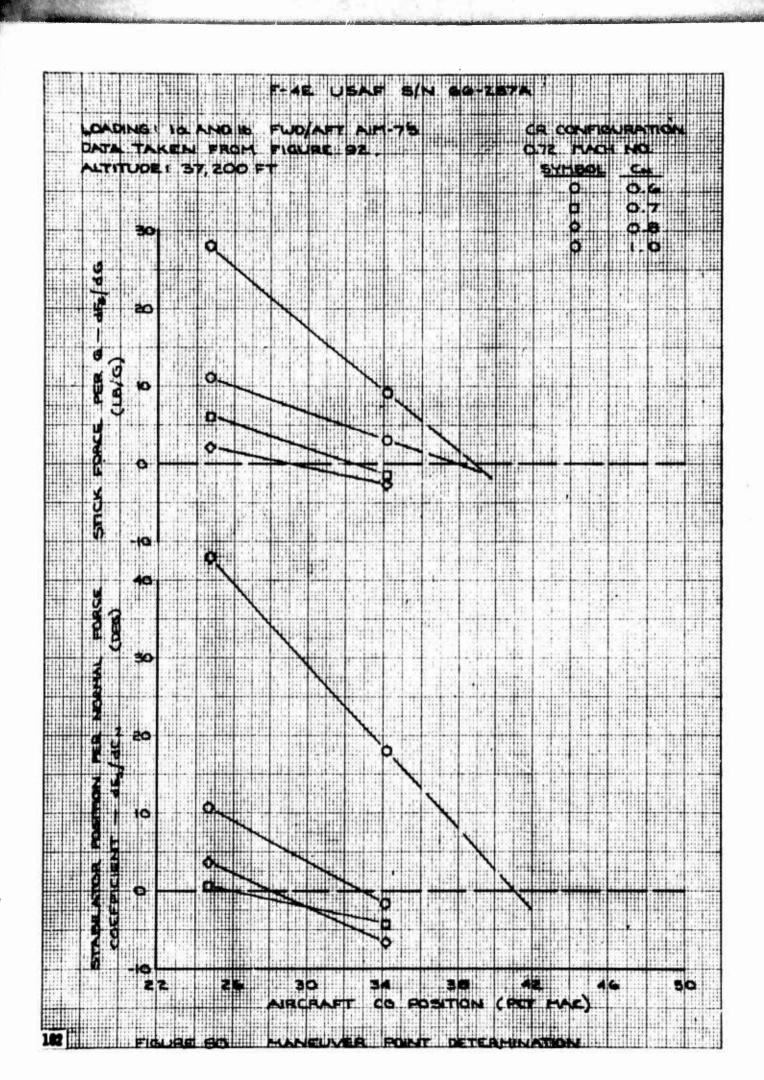
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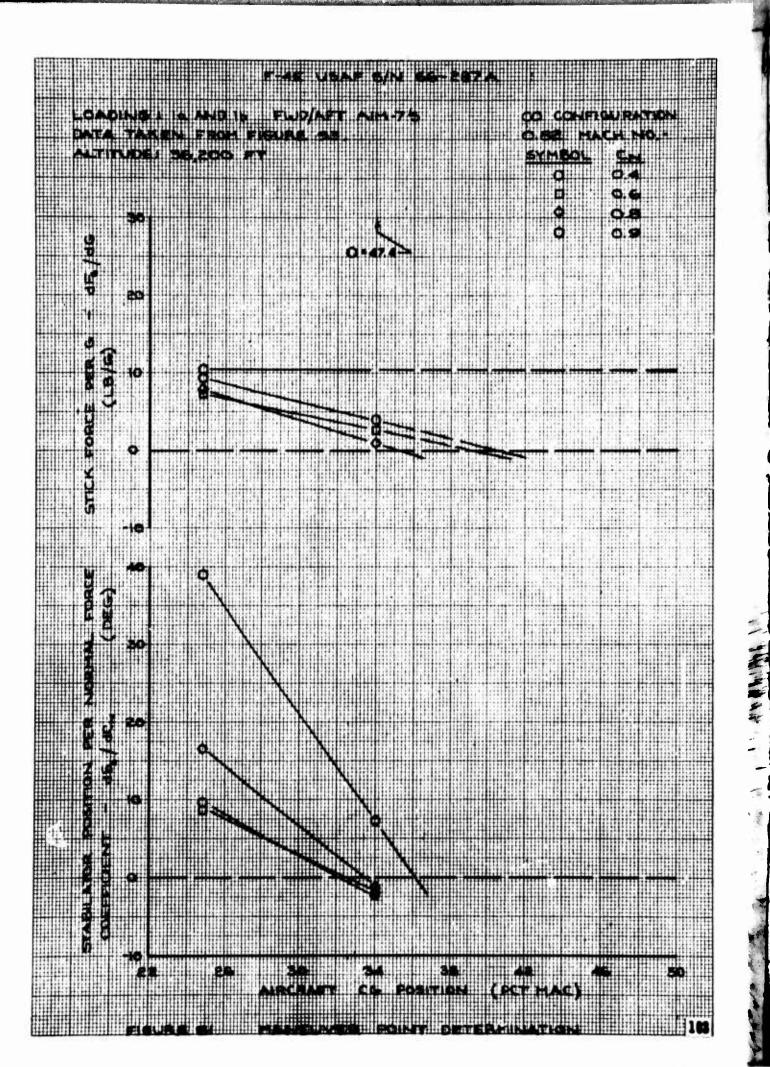


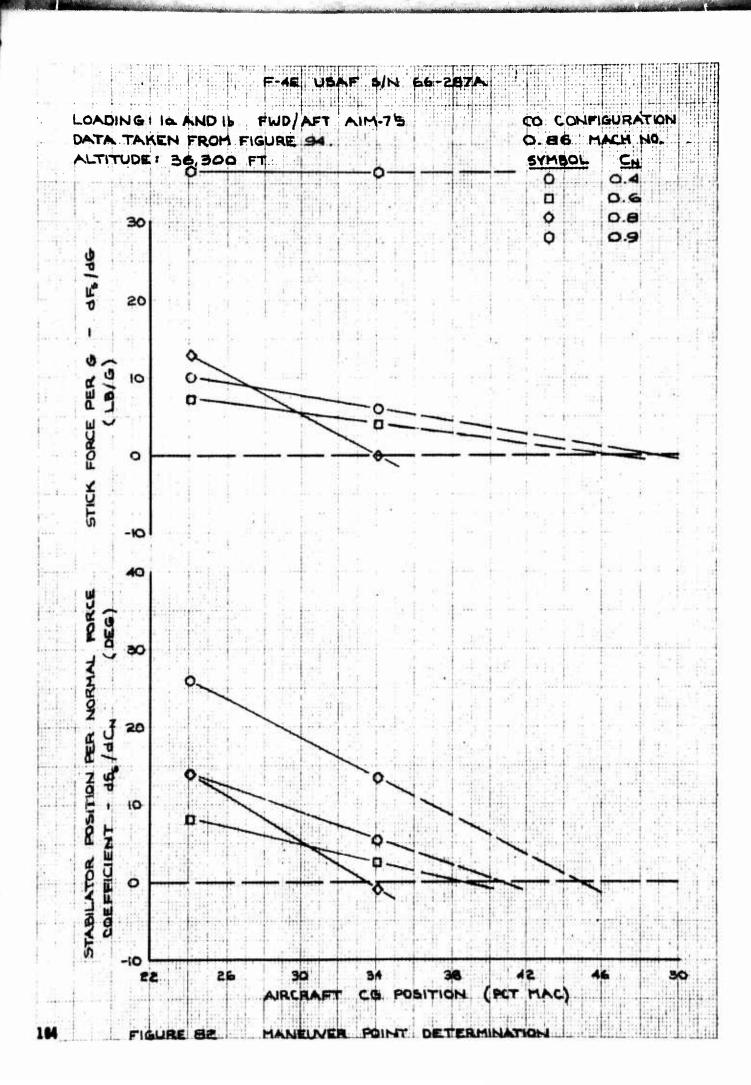


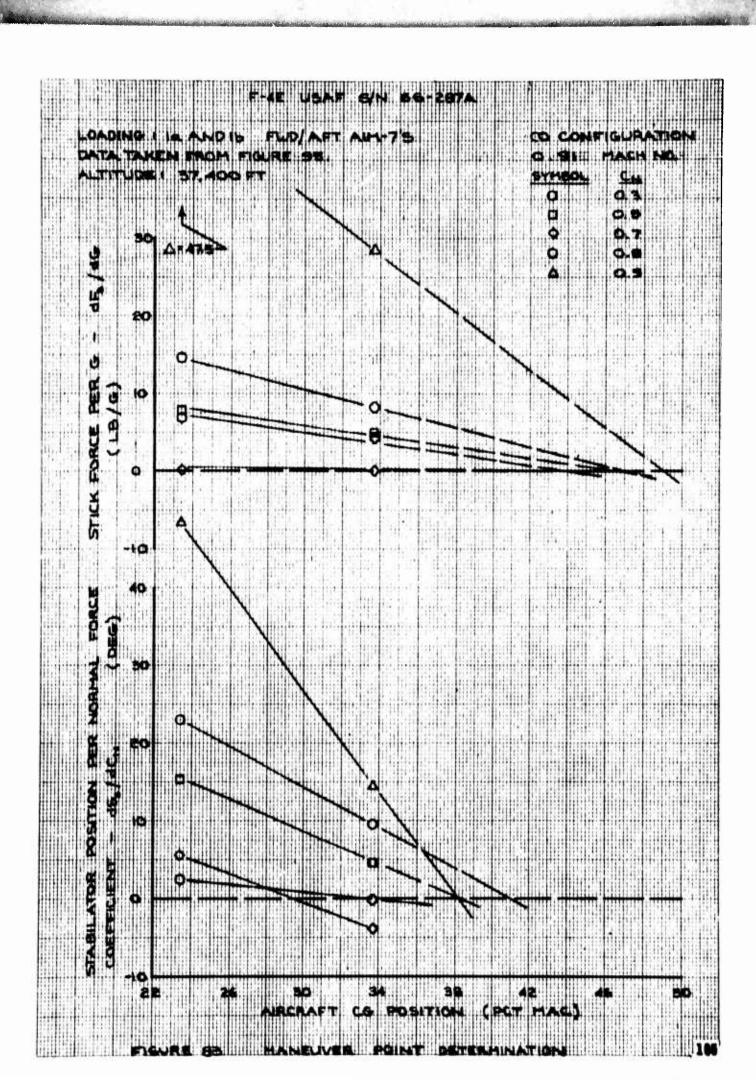


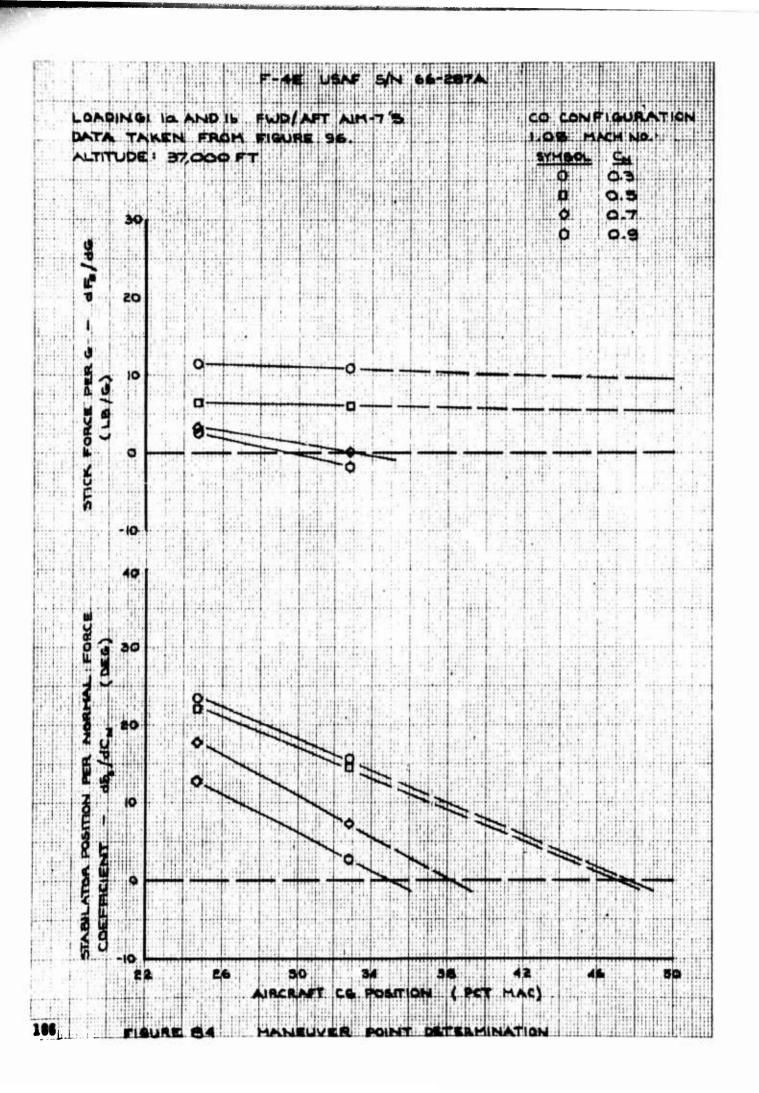




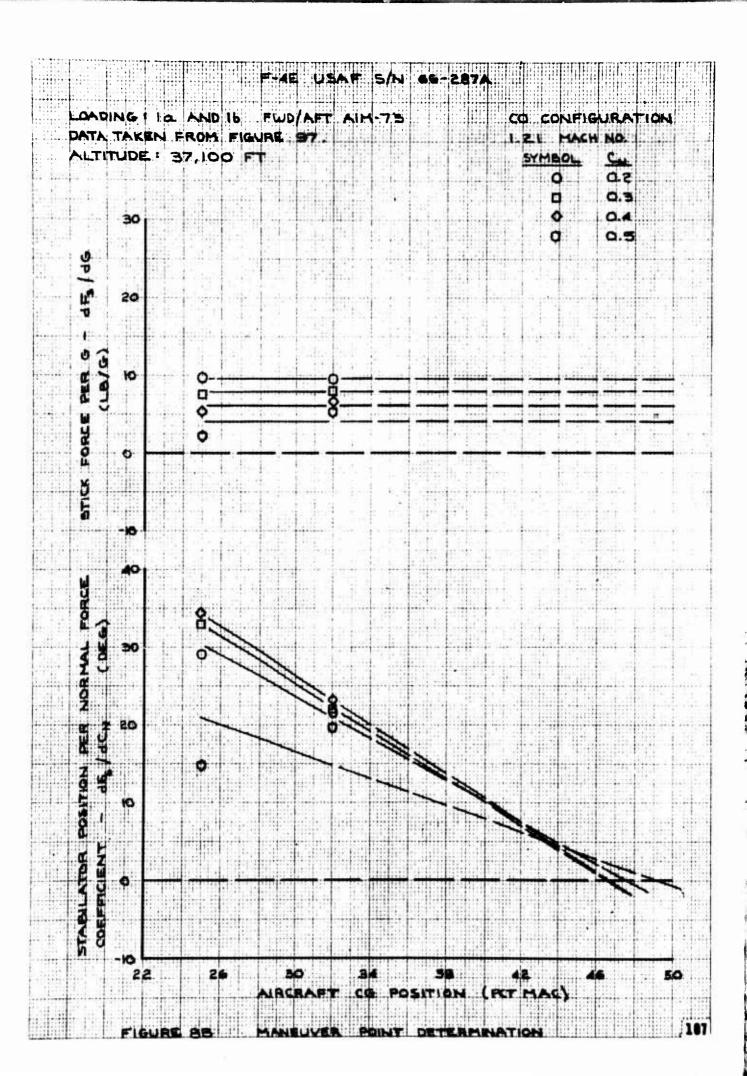


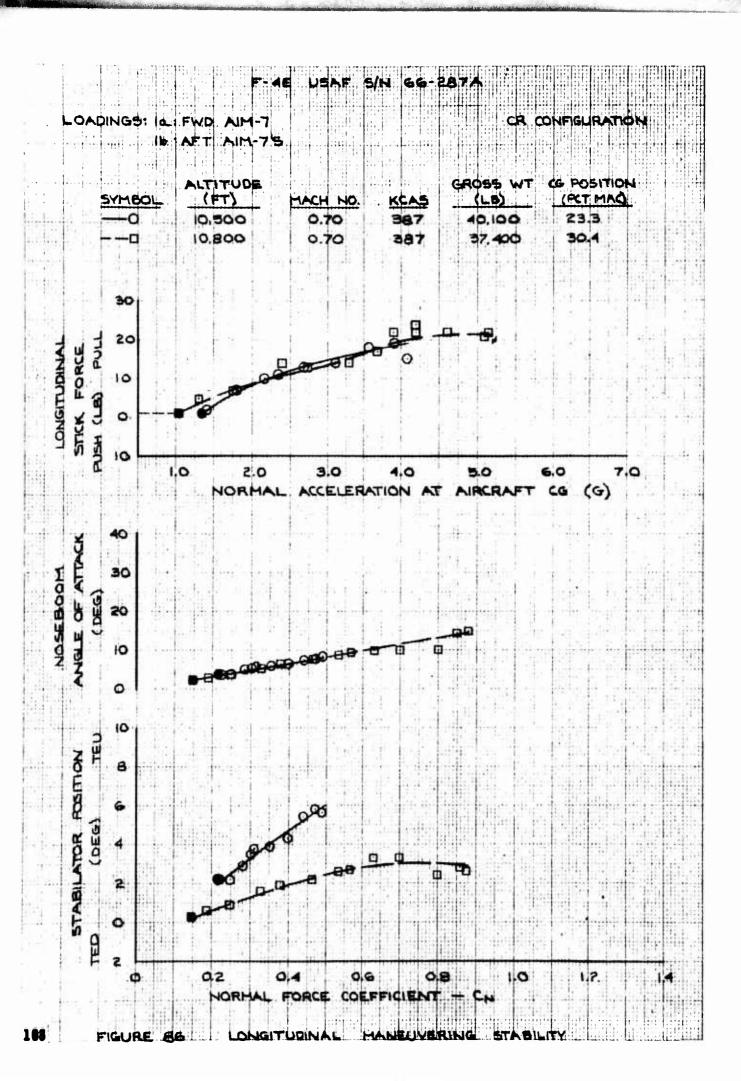


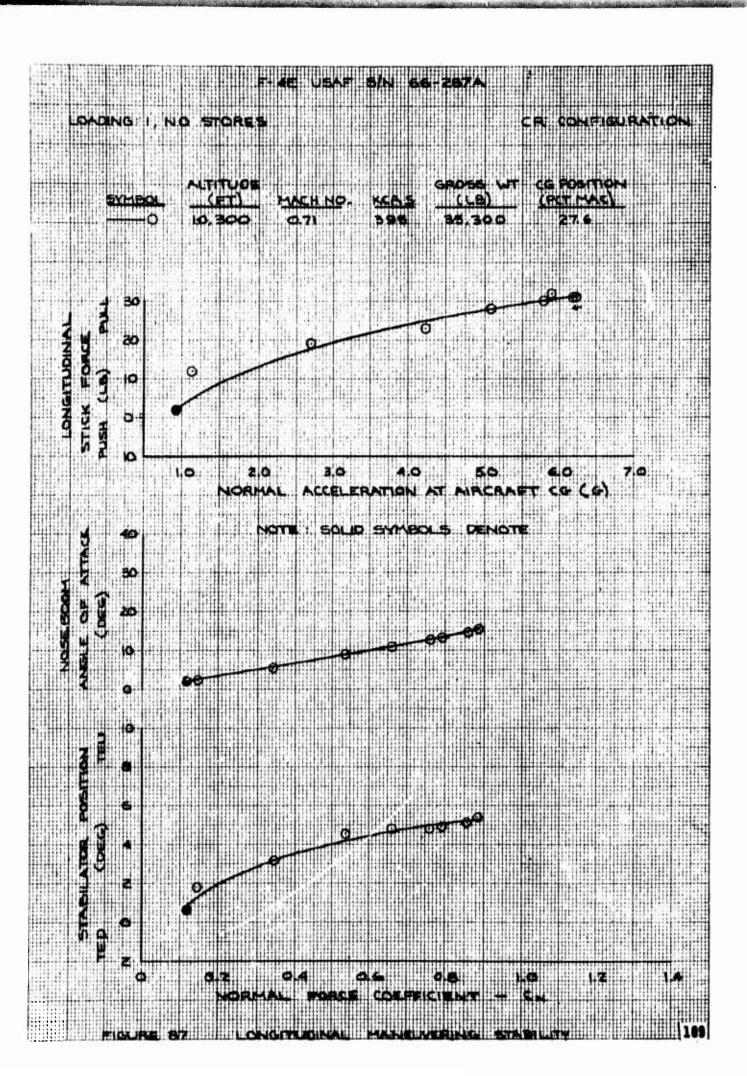




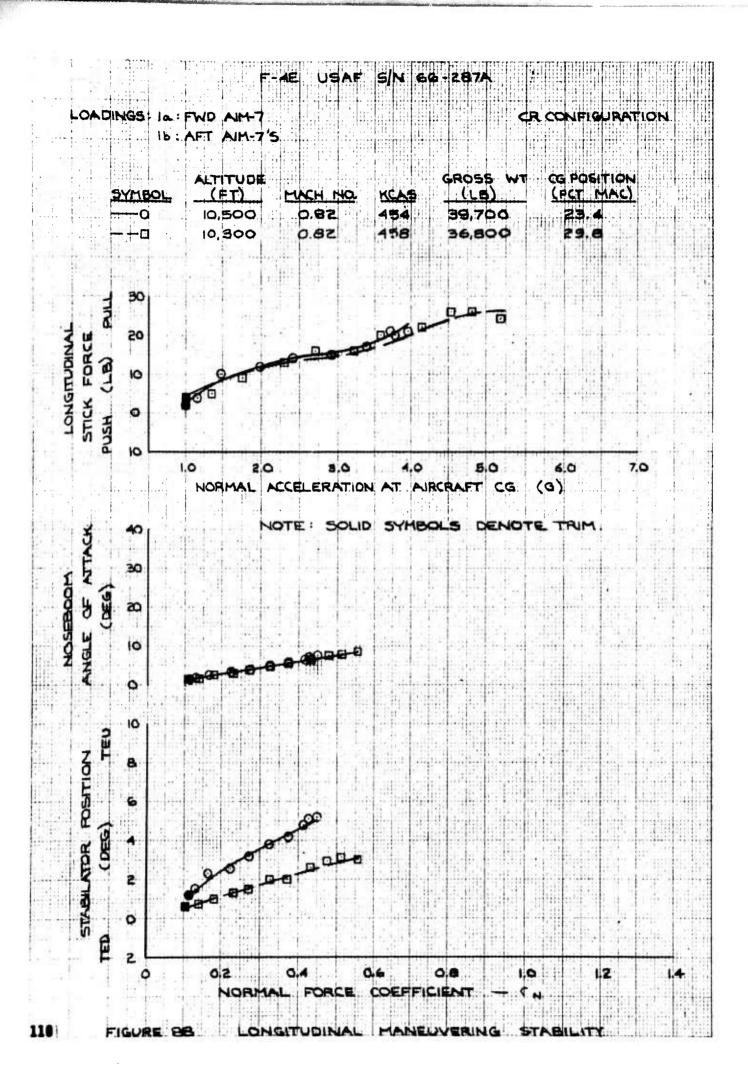
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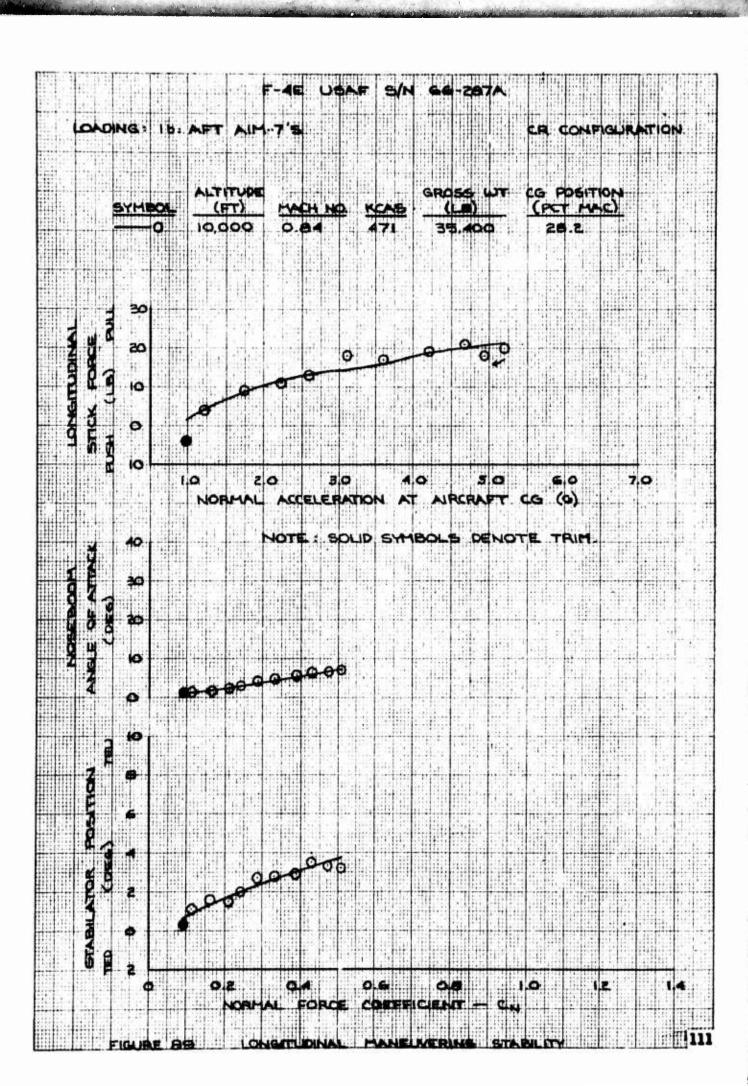


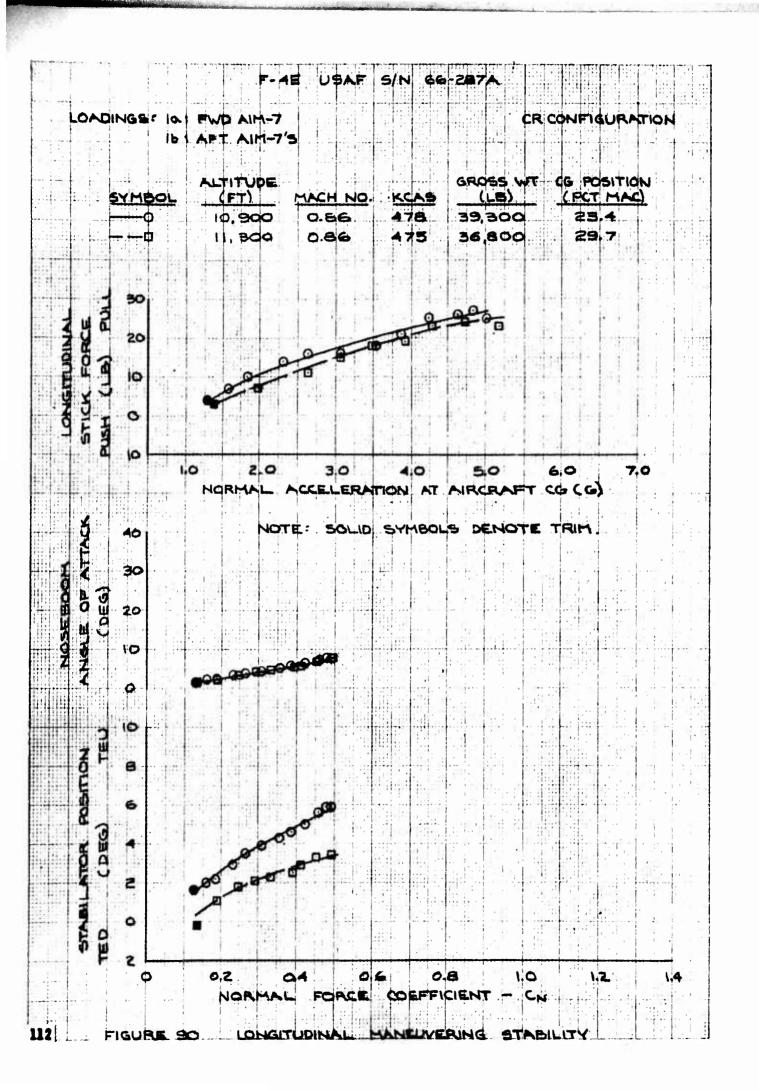


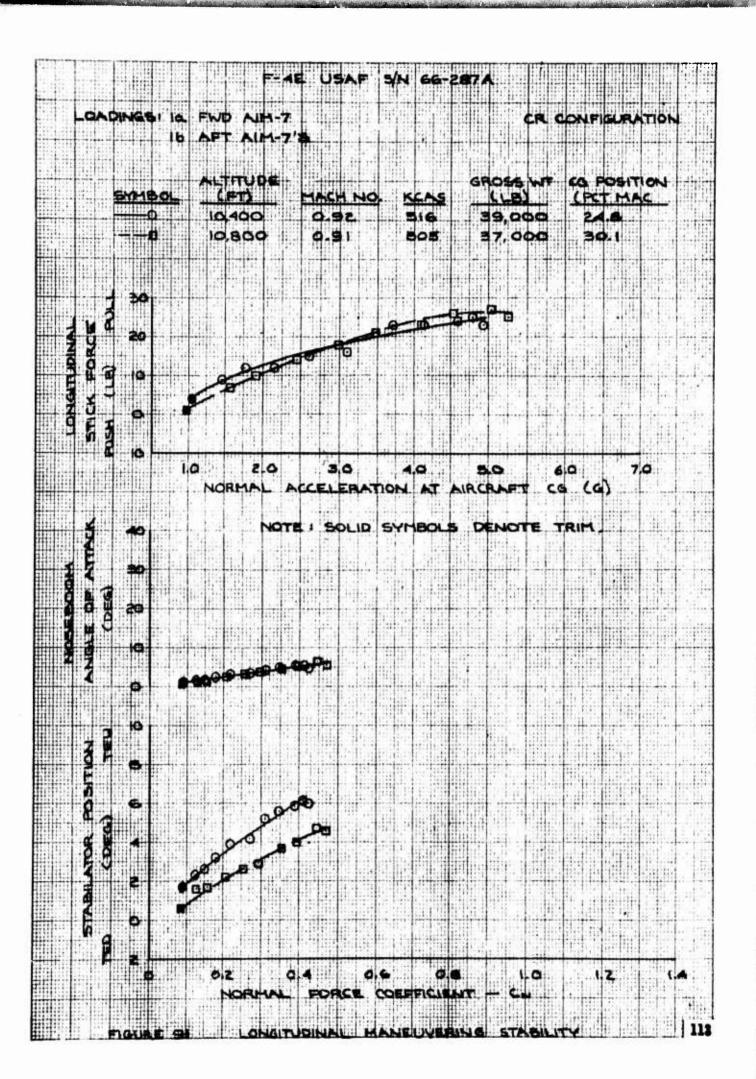


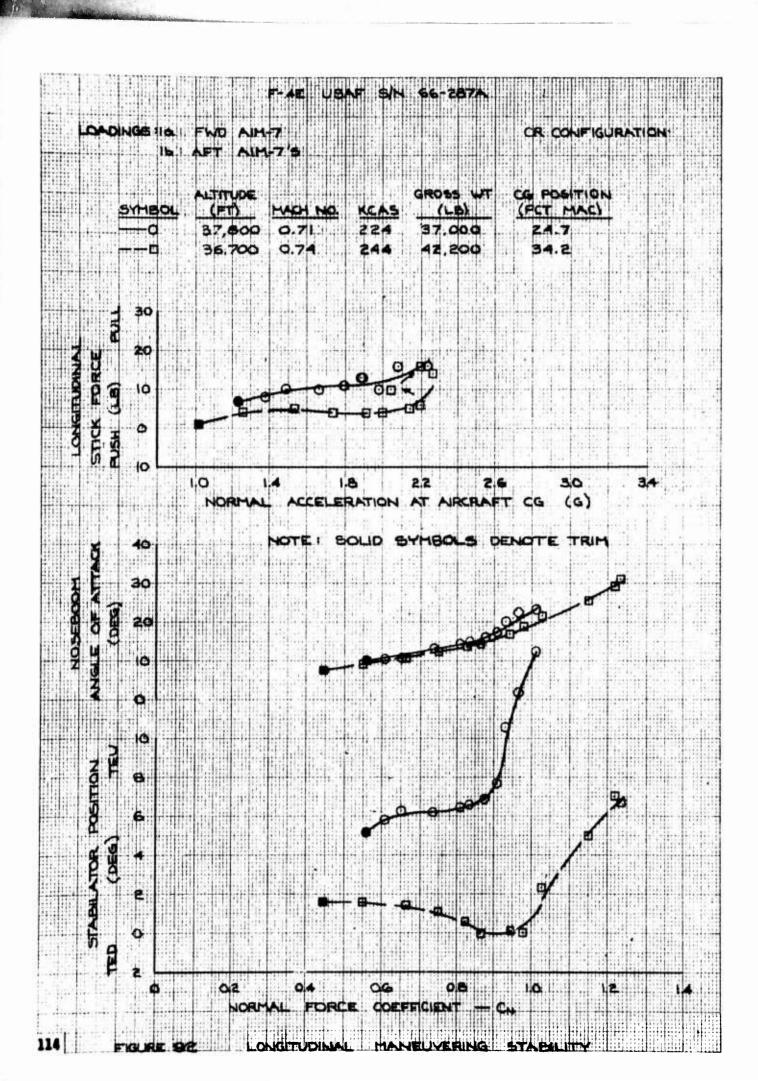
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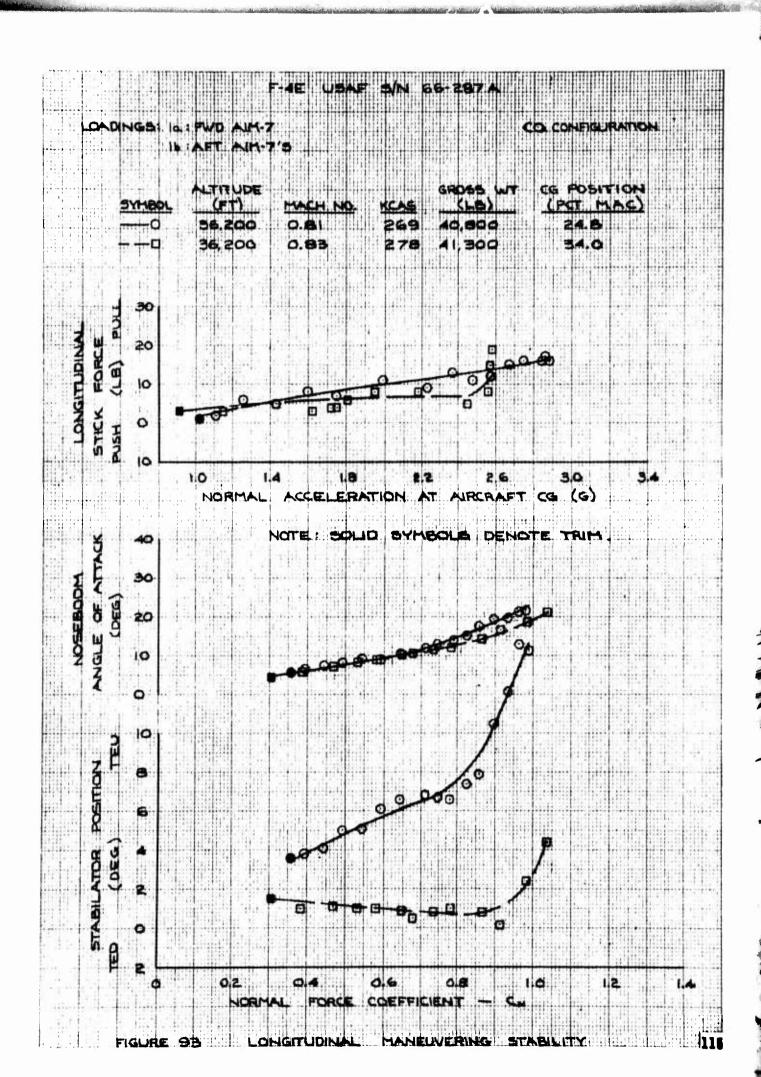


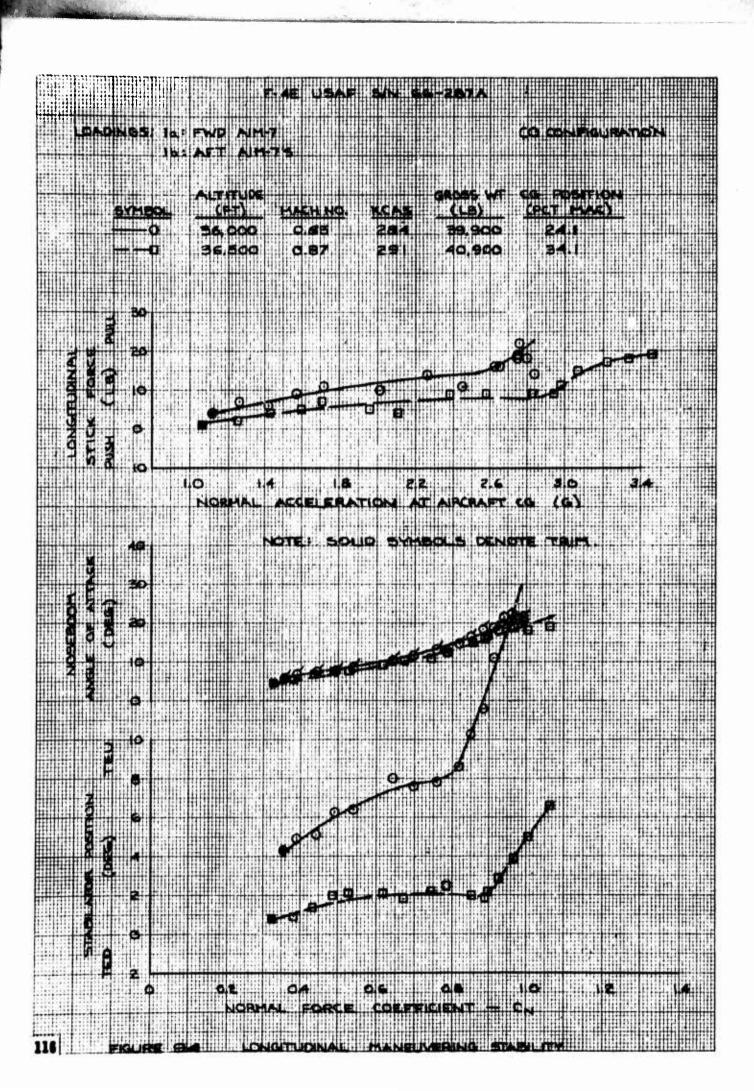


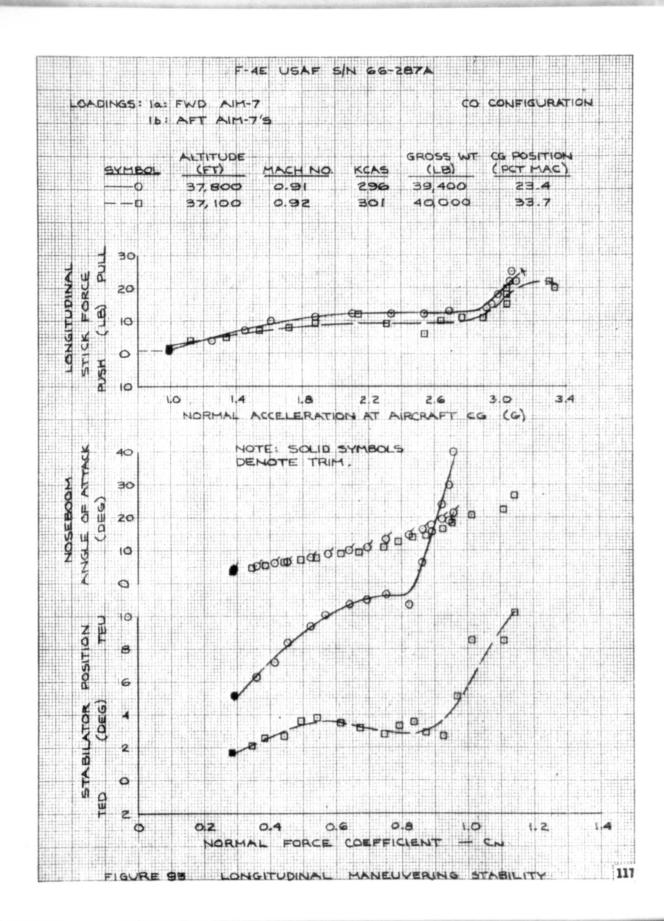


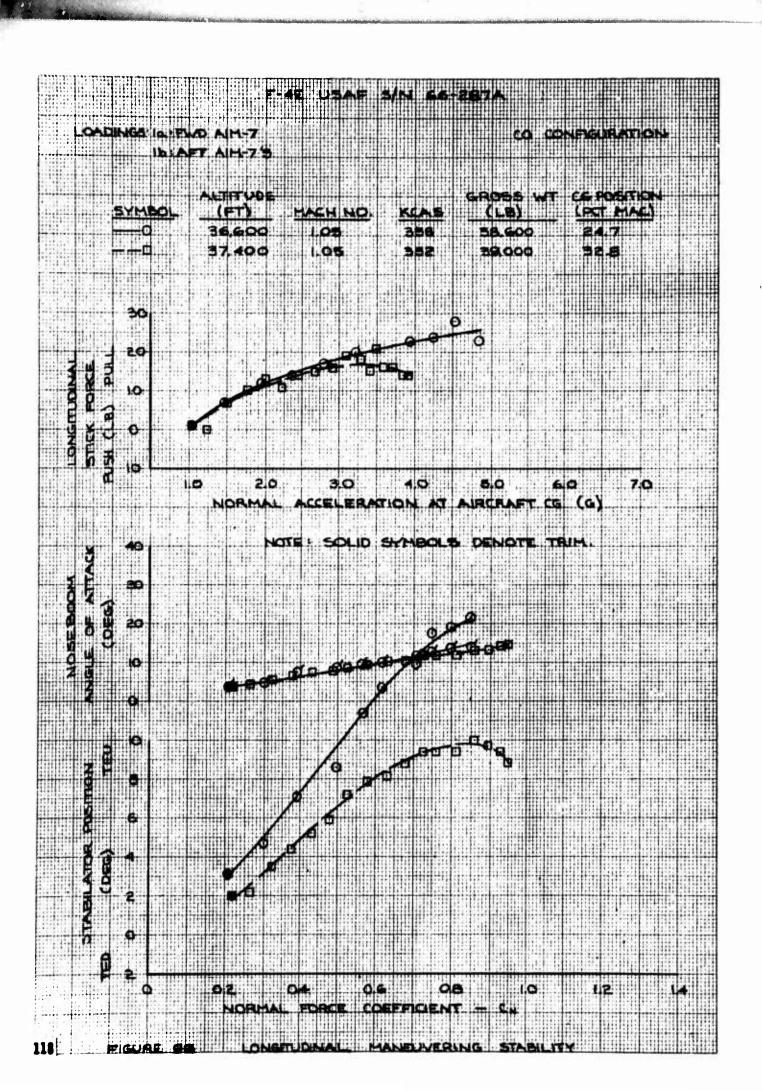




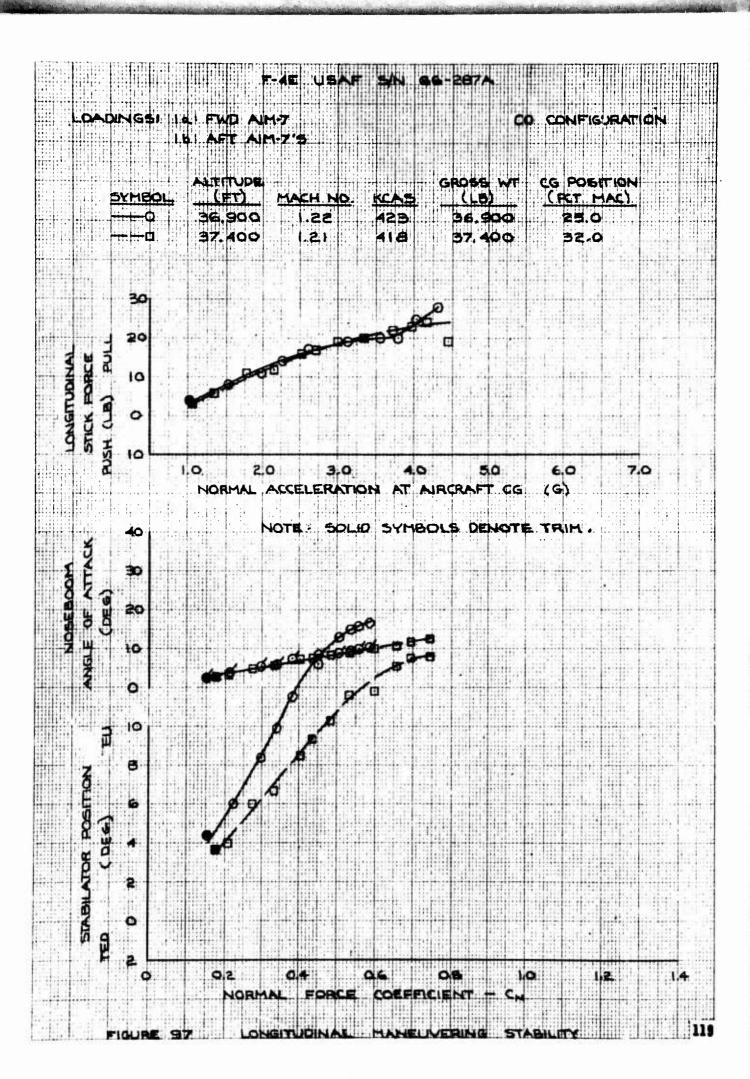


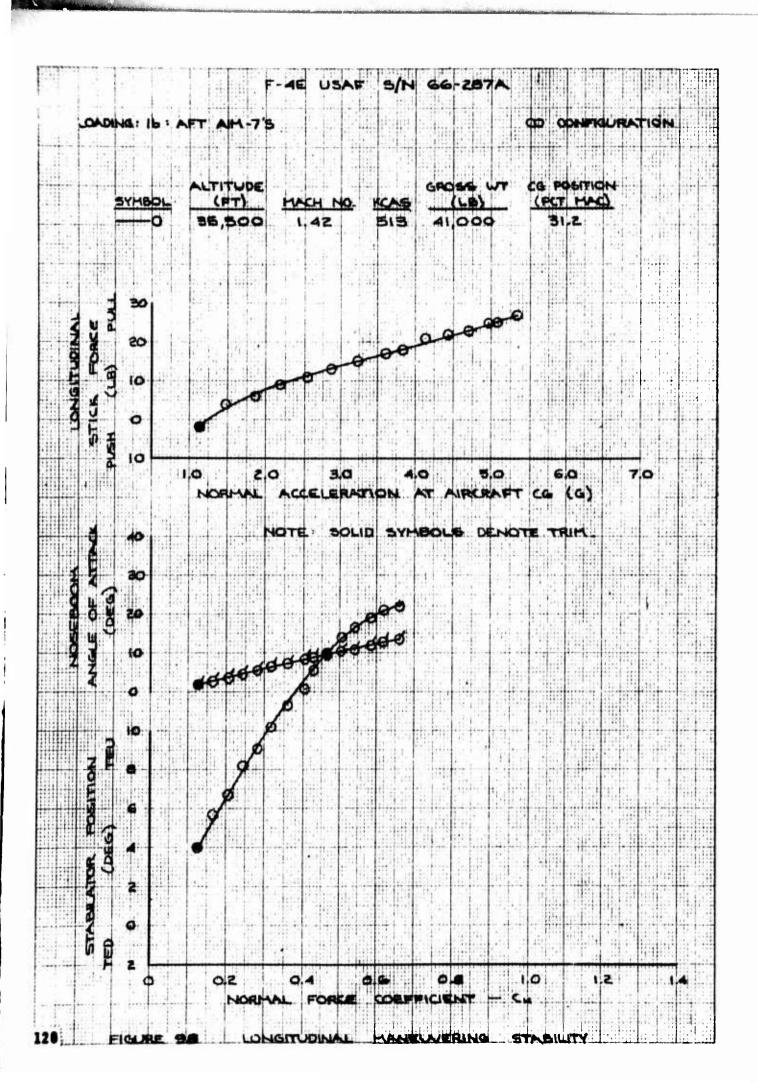


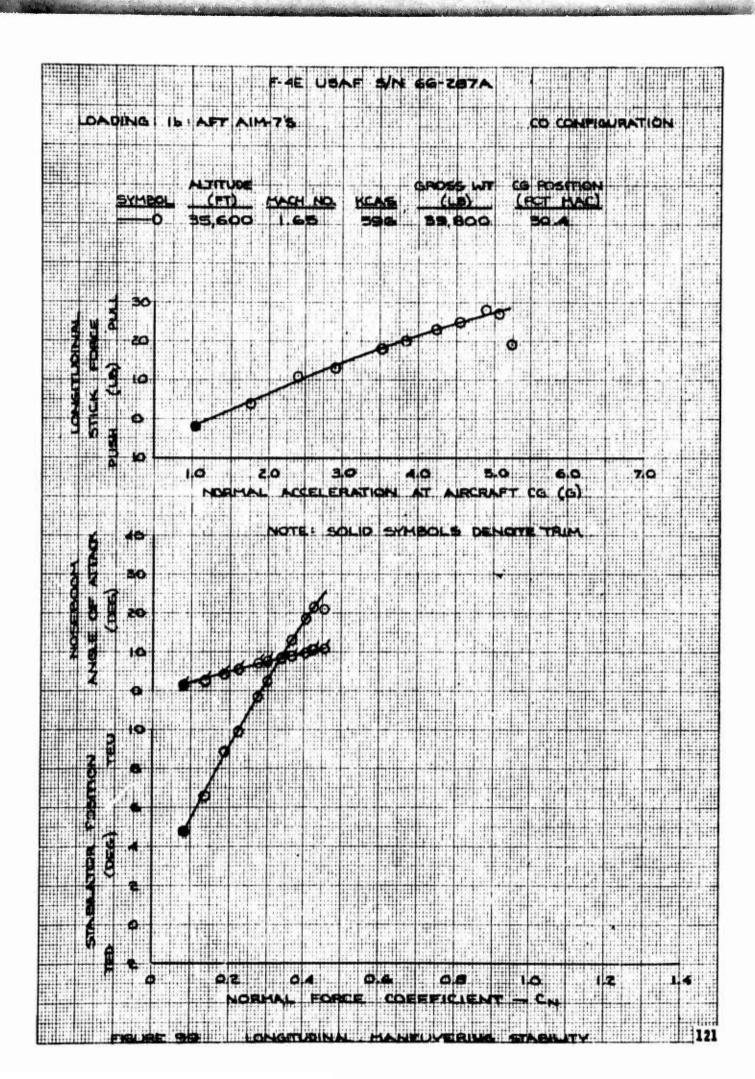




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#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

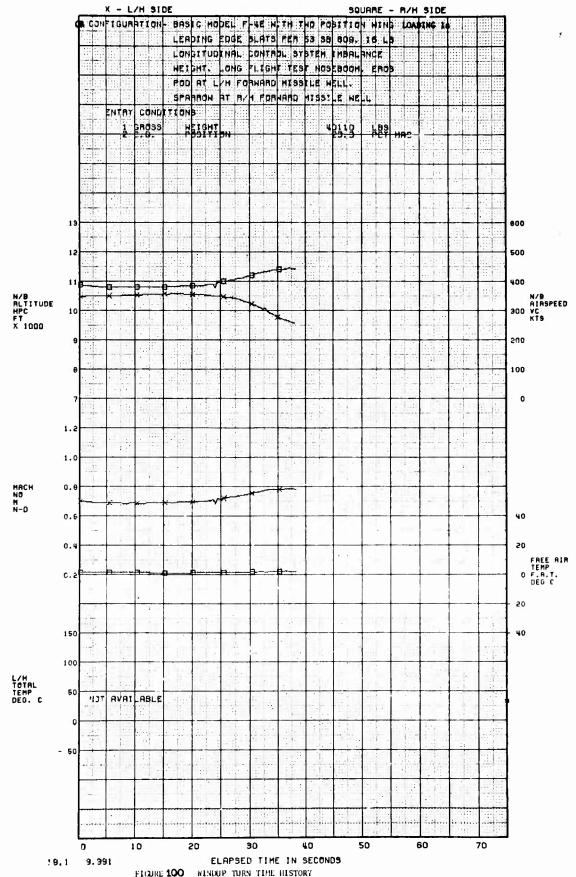
FLT 287-261

RUN 08 DATE 12 MAY 1972

MCAIR NO. 2280

USRF 9/N 66-0287

HIND-UP-TURN



# FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

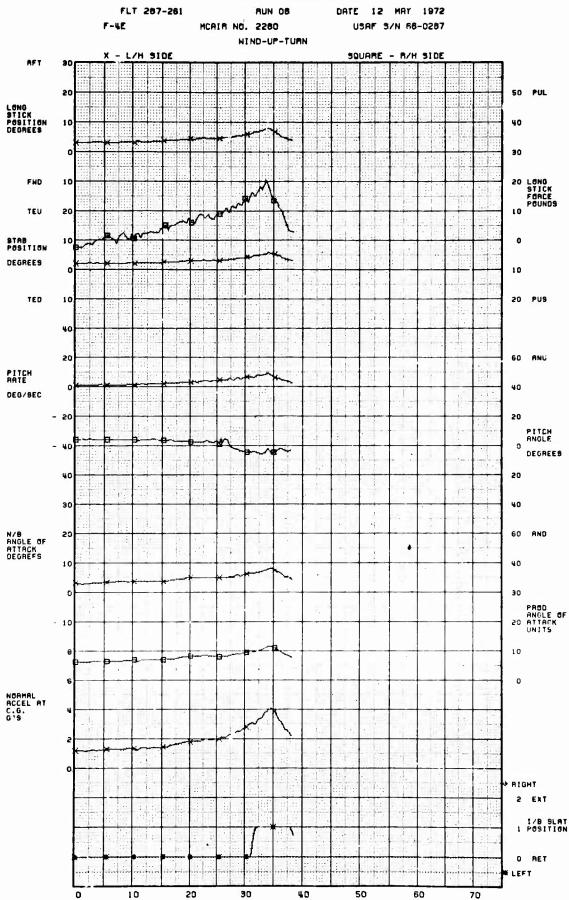


FIGURE 100 WINDUP TURN TIME HISTORY ( CONTINUED )

FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH THO POSITION MANEUVERING SLATS

FLT 287-261 RUN 06 DATE 12 MAY 1972
F-WE MCAIR NO. 2280 USAF 5/N 68-0287
WIND-UP-TURN

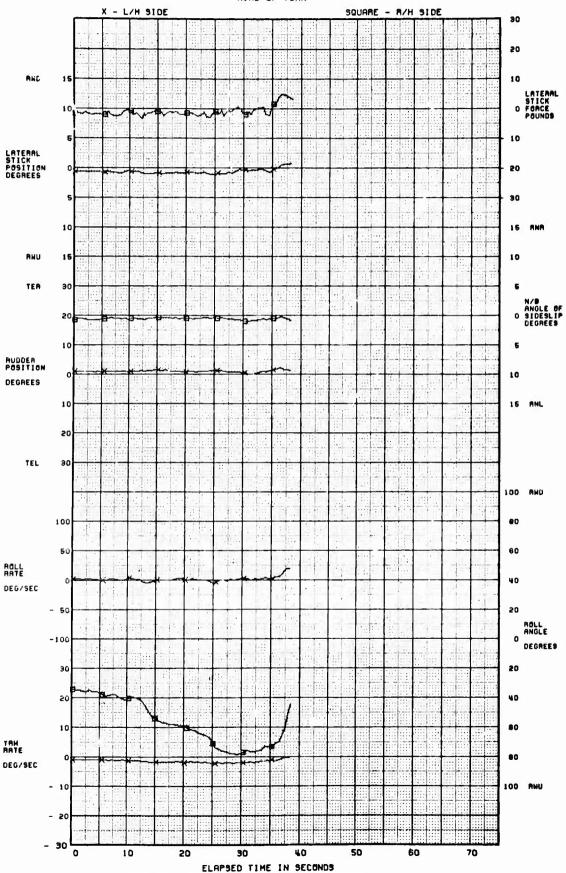
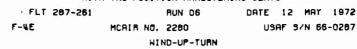
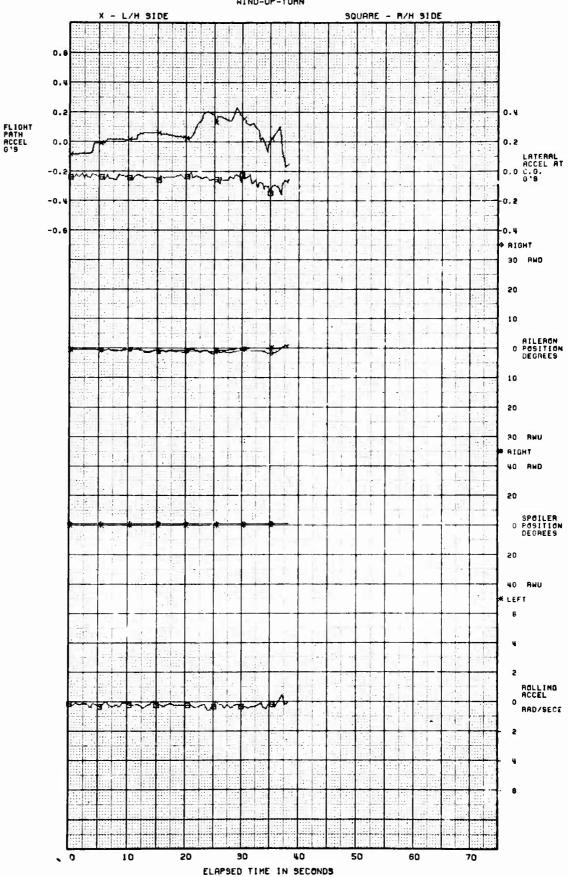


FIGURE 100 WINDUP TURN TIME HISTORY ( CONTINUED )

FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS





## FLIGHT TEST EVALUATION OF THE MODEL F-WE WITH THE POSITION MANEUVERING SLATS

FLT 287-263

**RUN 13** 

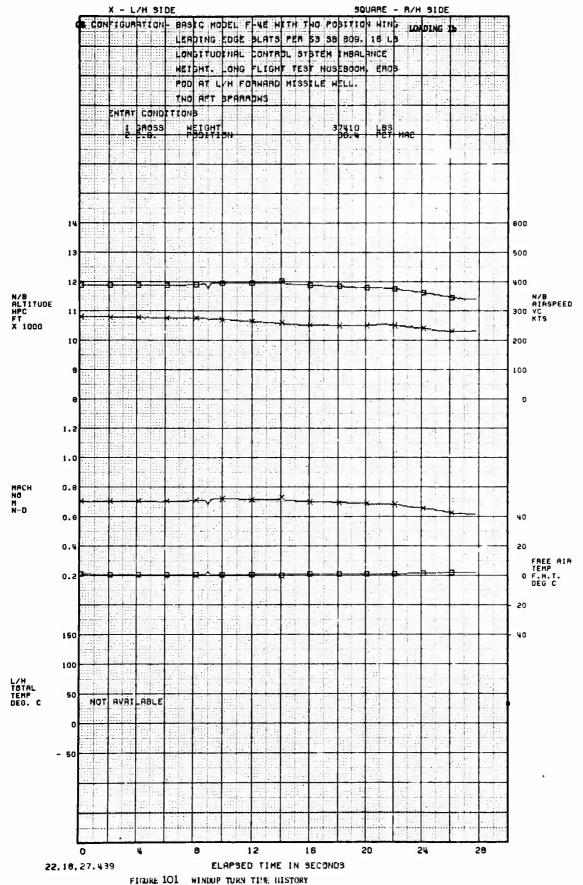
DATE 15 MAY 1972

F-4E

MCAIR NO. 2280

USRF 3/N 66-0287

HIND-UP-TURN



FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH THO POSITION MANEUVERING SLATS

FLT 287-263 RUN 13 DATE 15 MAY 1972
F-WE MCAIR NO. 2280 USAF 3/N 66-0287
HIND-UP-TURN

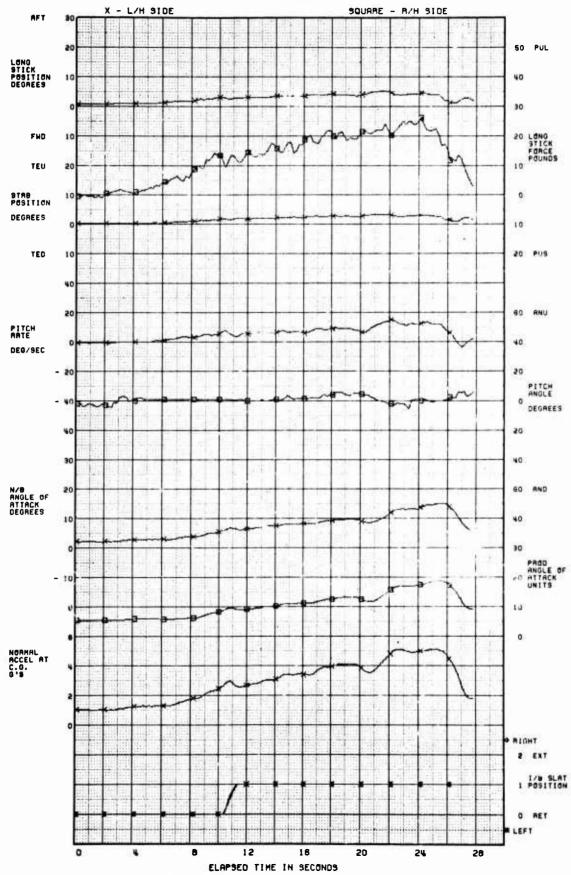


FIGURE 101 WINDUP TURN TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS FLT 287-263 DATE 15 MAY 1972 **RUN 13** F-4E MCAIR NO. 2280 USAF 3/N 68-0287 WIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE

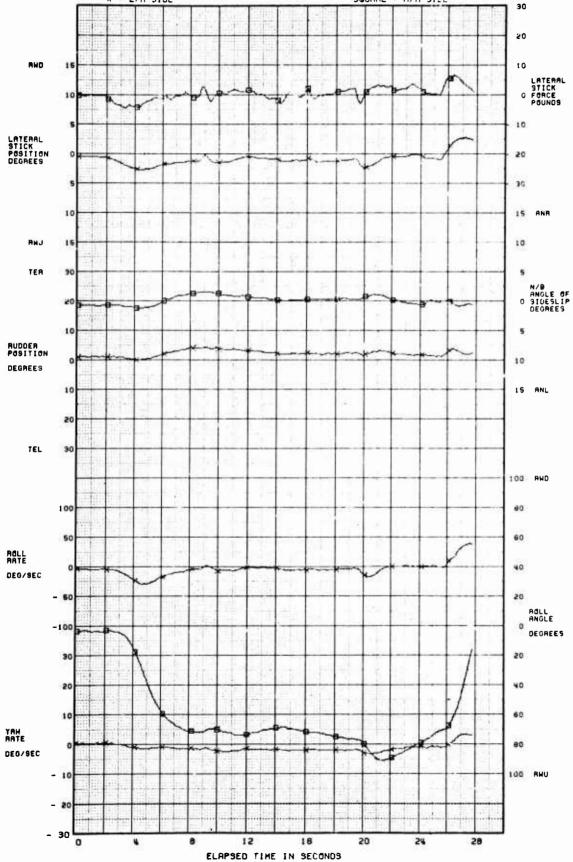


FIGURE 101 WINDUP TURN TIME HISTORY ( CONTINUED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-WE WITH THE POSITION MANEUVERING SLATS

FLT 287-263 **RUN 13** 

DATE 15 KAT 1972 USAF 3/N 65-0287 F-4E MCAIR NO. 2280 MIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE 0.4 0.5 0.4 FLIGHT PATH ACCEL D'S LATERAL ACCEL AT 0.0 C.O. G'3 -0.4 0.2 -0.8 0.4 THOIR 9 30 AHO RIGHT 40 RMD SPOILER O POSITION DEGREES 20 40 AMU LEFT ACCEL THE AAD/SEC2

ELAPSED FIME IN SECONDS FIGURE 101 WINDUP TURN TIME HISTORY ( CONCLUDED )

### FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS

FLT 287-261 F-4E

RUN 08 MCAIR NO. 2280

DATE 12 MAY 1972 USAF 3/N 66-0267

NIND-UP-TURN

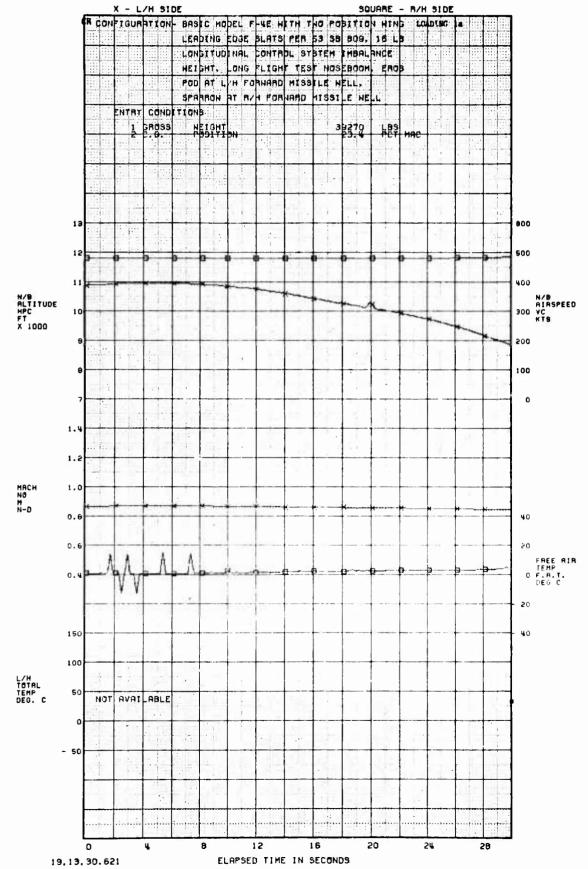


FIGURE 102 KINDUP TURN TIME HISTORY

### FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS FLT 287-261 RUN DB DATE 12 MAY 1972 F-4E MCRIR NO. 2280 USRF S/N 66-0267 HIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE AFT 301 50 PUL 50 40 20 LONG STICK FORCE POUNDS FHD 10 TEU STAB POSITION 0 DEGREES 10 TED 20 PU9 40 60 ANU PITCH 40 DEG/SEC 20 - 20 PITCH ANGLE DEGREES 20 40 10 NORMAL ACCEL AT C.G. G'S P RIGHT O RET

12

FIGURE 102 WINDUP TURN TIME HISTORY ( CONTINUED )

ELAPSED TIME IN SECONDS

24

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-261 RUN 08 DATE 12 MAY 1972

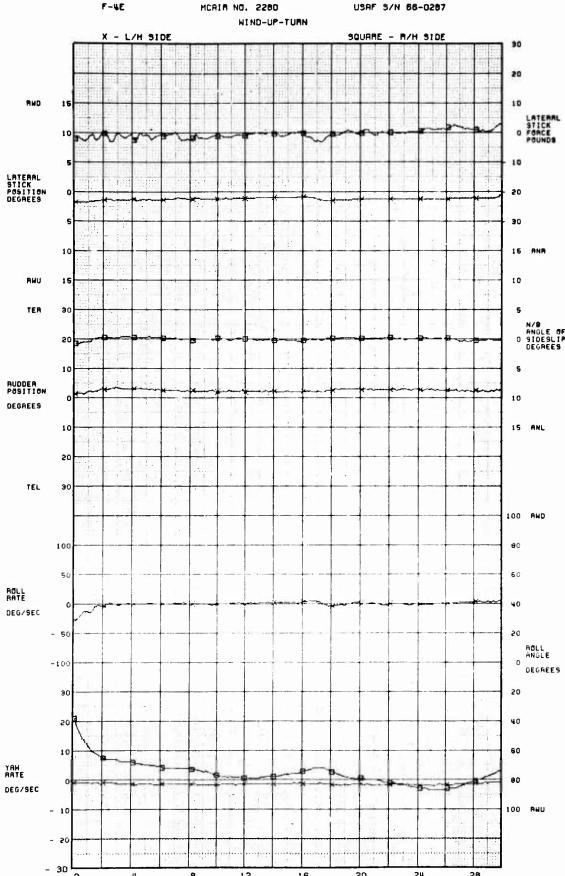


FIGURE 102 WINDUP THEN TIME HISTORY ( CONTINUED)

ELAPSED TIME IN SECONDS

FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-261

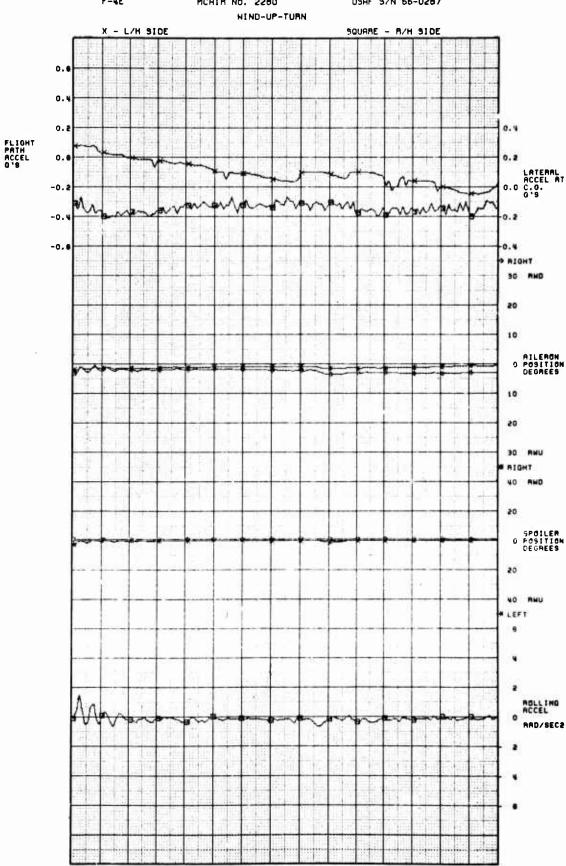
AUN DB

DATE 12 HAY 1972

F-4E

MCRIR NO. 2280

USAF 3/N 66-0287



ELAPSED TIME IN SECONDS

#### FLIGHT TEST EVALUATION OF THE MOUEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-263

RUN 15 DATE 15 MAY 1972 MCAIR NO. 2280 USAF 3/N 68-0287 WIND-UP-TURN X - L/H SIDE SQUARE - A/H SIDE BASIC MODEL F-48 WITH THO POSITION HIND LOADING IS LEADING EDGE SLATS PER 53 38 809. 18 LB CONFIGURATION-LONGITUDINAL CONTROL SYSTEM INBALANCE HEIGHT. LONG FLIGHT TEST NOSEBOOM, EROB POD AT LYH FORMARD MISSILE WELL. THO AFT SPARROHS ENTRY CONDITIONS ROSS 38790 600 -0 -0---0 -0 0 -0-400 200 100 0.6 50 40 NOT AVAILABLE

FIGURE 103 WINDUP TURN TIME HISTORY

ELAPSED TIME IN SECONDS

0

22,19,31.38/

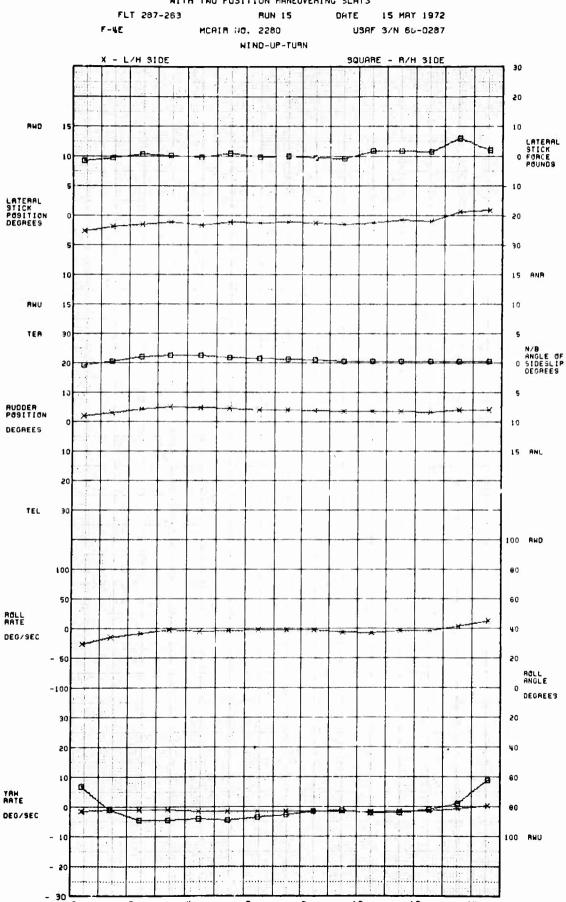
N/B ALTITUDE HPC FT X 1000

### FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE PESITION MANEUVERING SLATS FLT 287-263 DATE 15 MAY 1972 **RUN 15** F-4E USAF 3/N 68-0287 MCAIR NO. 2280 NIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE AFT 50 PUL LONG STICK PUSITION DEGREES 10 40 30 20 LONG STICK FORCE POUNDS FHD 10 10 TEU 50 STAB POSITION 10 0 DEGREES 10 TED 20. PU9 10 40 PITCH BATE DEG/9FC DEGREES 30 40 N/B ANGLE OF ATTACK DEGRFES 60 AND 10 NORMAL ACCEL AT C.O. G'S RIGHT 1/B SLAT 1 POSITION O RET 6 10 12 14

ELAPSED TIME IN SECONDS

# FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS



ELAPSED TIME IN SECONDS

FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-263 RUN IS 15 MAY 1972 MCAIR NO. 2280

F-4E USAF S/N 66-0287 NIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE 0.6 0.4 0.2 FLIGHT PATH ACCEL 6'8 LATERAL ACCEL AT 0.0 C.G. G'9 -0.4 -0.4 -0.6 RIGHT 30 RHD 20 AILERON O POSITION DEGREES 10 20 10 AHU 40 RHU RAD/SEC2

> ELAPSED TIME IN SECONDS FIGURE 103 WINDUP THEN TIME HISTORY ( CONCLUDED )

15

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-262

RUN 19

DATE 12 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

HIND-UP-TURN SQUARE - R/H SIDE X - L/H SIDE R CONFIGURATION- BASIC MODEL F-4E WITH THO POSITION HIND: LOADING LONGITUDINAL CONTADL SYSTEM THBALANCE HEIGHT. ONG FLIGHT TEST 103EBOOM, EROS POD AT LVH FORNARD MISSILE WELL. SPARROW AT RVH FORNARD MISSILE WE ENTRY CONDITIONS ER 135 37040 600 37 500 400 N/B ALTITUDE HPC FT X 1000 N/B AIASPEED 300 VC KTS 500 33 100 32 1.0 HACH NU M N-D 0.6 FREE AIR TEMP 60 F.A.T. DEG C 60 100 160 100 HOT AVAI ABLE 24 ELAPSED TIME IN SECONDS

20, 17, 31.875

FIGURE 104 WINDUP TURN TIME HISTORY

### FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEU ERING SLATS

WITH THE POSITION MANEU ERING SLATS FLT 287-262 **RUN 13** LATE 12 MAY 1972 F-4E USAF 3/N 58-0287 MCRIR NO. 2280 NIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE BET 301 50 50 PUL 40 30 20 LONG STICK FORCE POUNDS FHD 10 10 TEU 20 STAB POSITION 0 10 DEGREES 10 TED 20 PUS 10 40 20 60 ANU PITCH BATE 40 DEG/SEC DEGREES sc 40 40 30 N/B ANGLE OF ATTACK DEGREES 60 AND 50 10 40 30 NORMAL ACCEL AT C.G. B'9 ATCHT + O RET LEFT 24 28

FIGURE 104 KINNEP TURN TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-WE MITH THO POSITION MANEUVERING SLATS

FLT 287-262

**RUN 13** 

DATE 12 MAY 1972

F-4E

MCRIR NO. 2280

USAF 3/N 66-0287

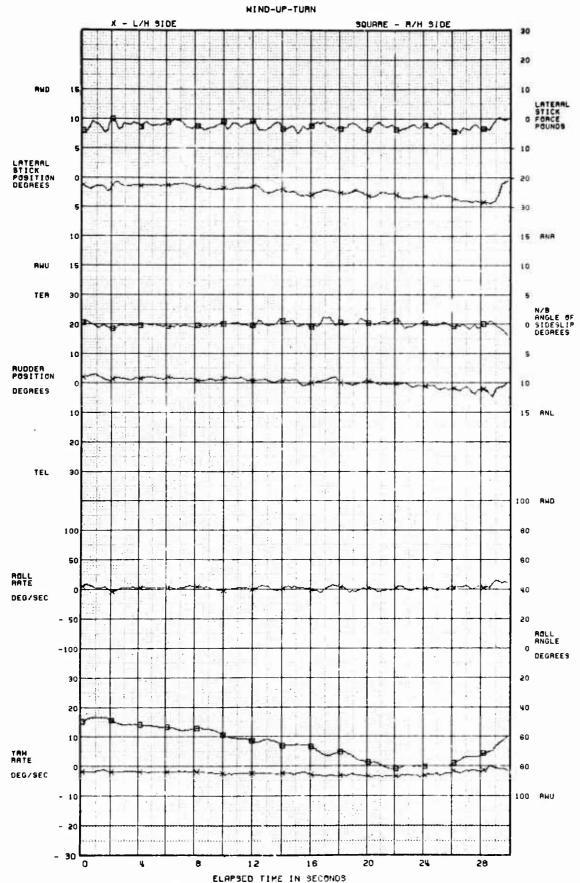


FIGURE 104 WINDUP TURN TIME HISTORY ( CONTINUED )

### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

DATE 12 MAY 1972 FLT 287-262 **RUN 13** USRF 3/N 66-0287 MCAIR NO. 2280 WIND-UP-TURN X - L/H SIDE 0.6 0.4 0.2 -0.2 -0.4 -0.8 э втент 30 RWD AILERON O POSITION DEGREES 10 40 ANU ACCEL ACCEL AAD/9EC2 ELAPSED TIME IN SECONDS

FIGURE 104 WINDUP TURN TIME HISTORY ( CONCLUDED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THE POSITION MANEUVERING SLATS

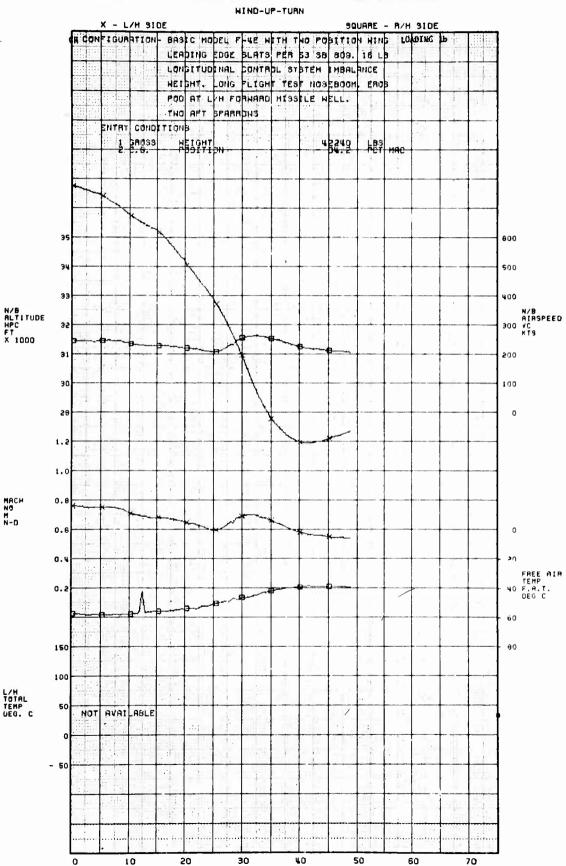
FLT 287-263

MUN 05 DATE 15 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 68-0287



142

22,11,19.720

FIGURE 105 WINDUP TURN TIME HISTORY

ELAPSED TIME IN SECONDS

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

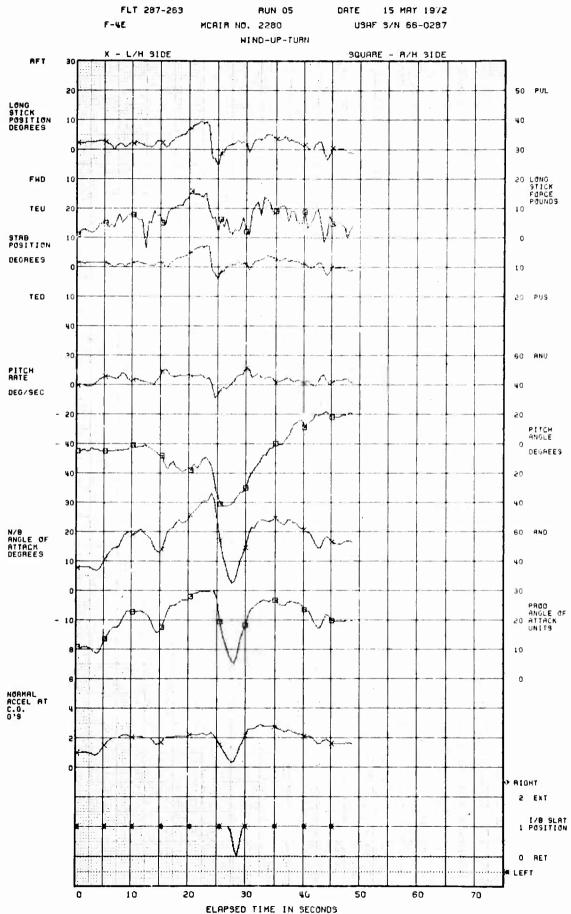


FIGURE 105 WINDUP TURN TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-263 DATE 15 MAY 1972 **RUN 05** F-4E USAF 3/N 68-0287 MCAIR NO. 2280 NIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE RND LATERAL STICK POSITION DEGREES RHU TER RUDDER POSITION 10 DEGREES TEL 100 00 50 ROLL DEG/SEC - 50 RØLL ANGLE -100 DEGREES 50 DEG/SEC 100 RHU - 20 - 30 10 60 70 90

ELAPSED TIME IN SECONDS

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

FLT 287-263

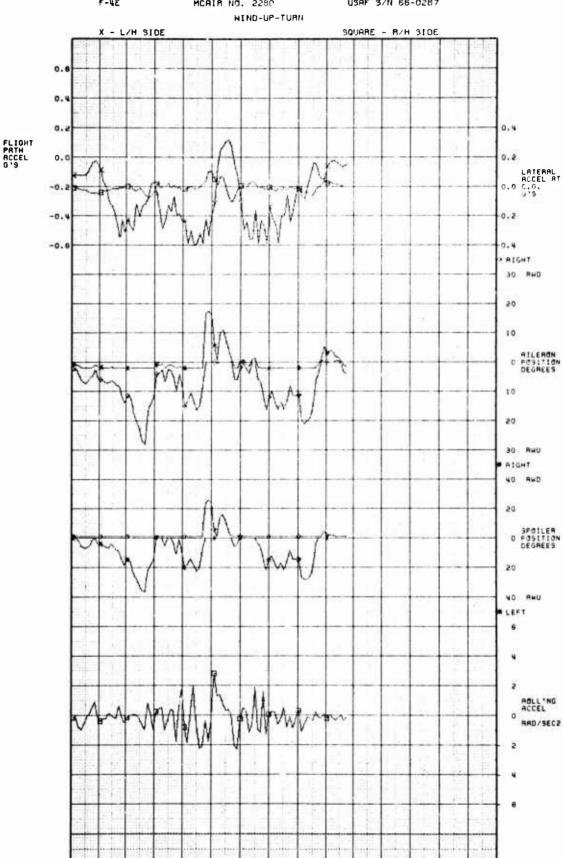
RUN 05

DATE 15 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287



ELAPSED TIME IN SECONDS

FIGURE 105 WINDUP TURN TIME HISTORY ( CONCLUDED )

145

## FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH THO POSITION MANEUVERING SLATS

FLT 287-262

RUN 08

DATE 12 MAY 1972 USAF 5/N 66-0287

F-4E

MCRIR NO. 2280

HIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE CONFIGURATION - BASIC MODEL F-48 HITH THO POBITION HIND LONDING IN LEADING EDGE BLATS PER 53 SB 809. 16 LB LONGITUDINAL CONTADA SYSTEM IMBALANCE HEIGHT. LONG FLIGHT TEST NOSEBOOM, ENDS POD AT L'H FORNARD MISSILE WELL. SPARADO AT BY FORMAND MISSIE WELL ENTRY CONDITIONS PAGSS 39890 600 500 N/B ALTITUDE HPC FT X 1000 N/B AIASPEED 900 VC KTS 100 1.2 1.0 0.6 20 0.6 FREE RIR TEMP 60 F.A.T. DEG C 0.4 90 100 150 100 L/H TOTAL TEMP DEG. C 50 NOT AVAILABLE 20 0 12 ELAPSED TIME IN SECONDS 20, 19, 20, 962

FIGURE 106 WINDUP TURN TIME HISTORY

# FLIGHT TEST EVALUATION OF THE MODEL F-WE WITH TWO POSITION MANEUVERING SLATS

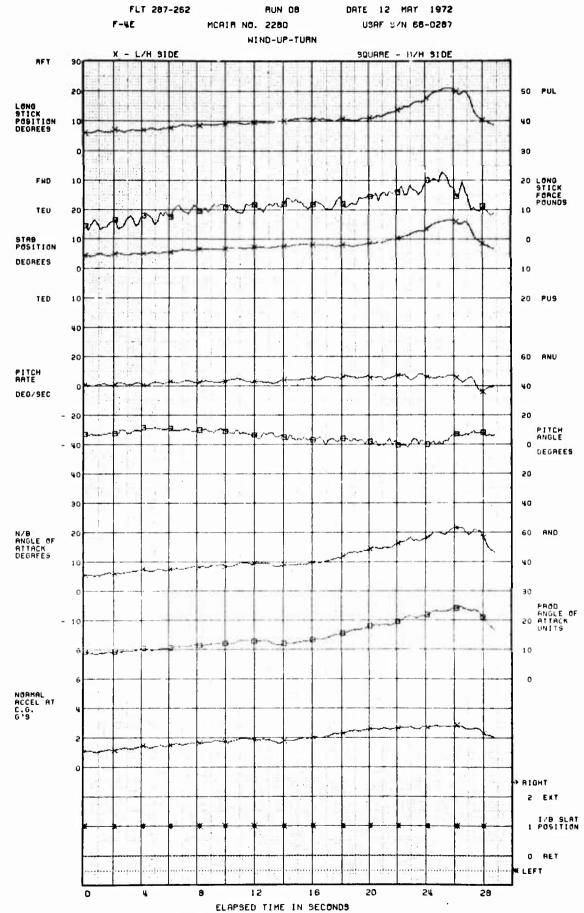


FIGURE 106 WINDUP TURN TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS:

FLT 287-262

RUN DB

DATE 12 MAY 1972

F-4E

MCAIR NO. 2280

USRF 3/N 66-0287

WIND-UP-TURN

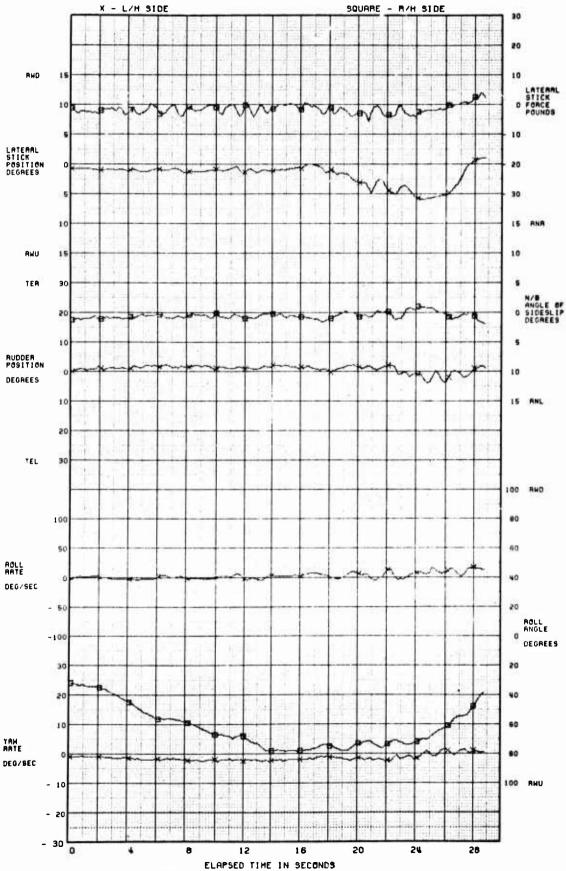


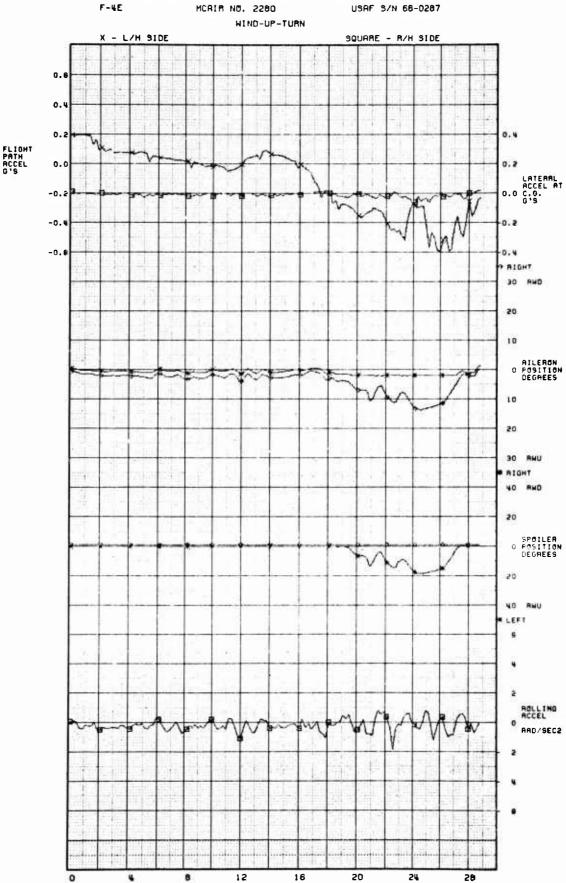
FIGURE 106 WINDER TURN TIME HISTORY ( CONTINUED )

FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-262

RUN OB

DATE 12 MAY 1972



ELAPSED TIME IN SECONDS FIGURE 106 WINDUP TURN TIME HISTORY ( CONCLUDED )

### FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS

FLT 207-263

BUN 07

DATE 15 MAY 1972 USAF 3/N 66-0287

MCRIR NO. 2280

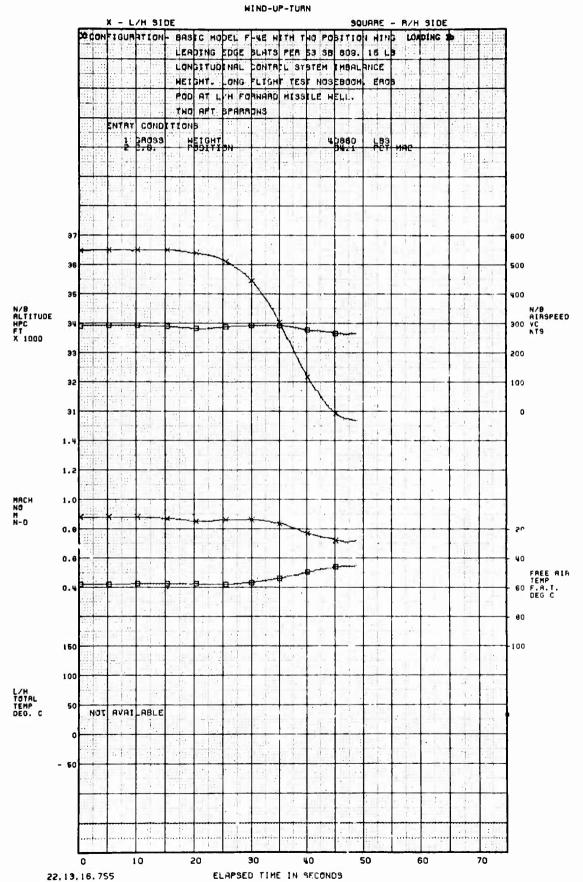


FIGURE 107 WINDUP TURN TIME HISTORY

## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

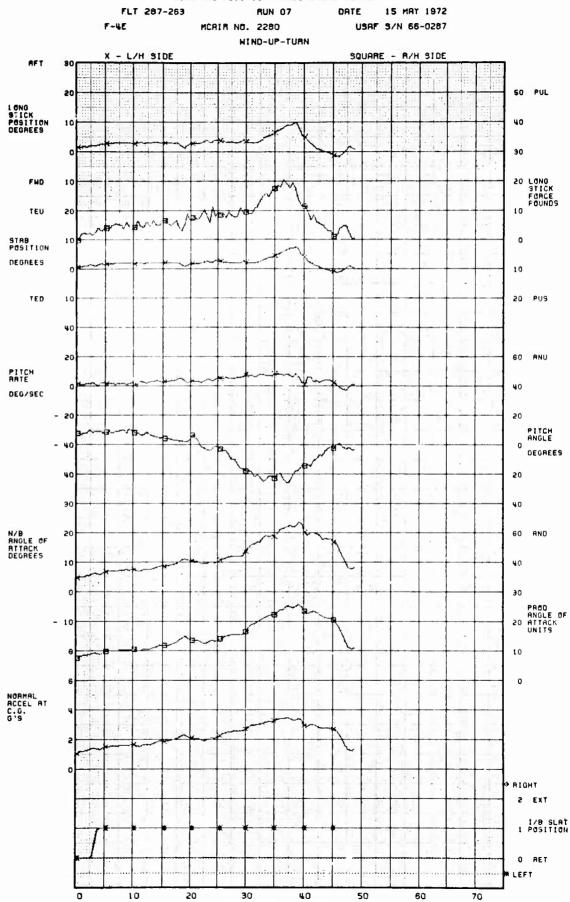
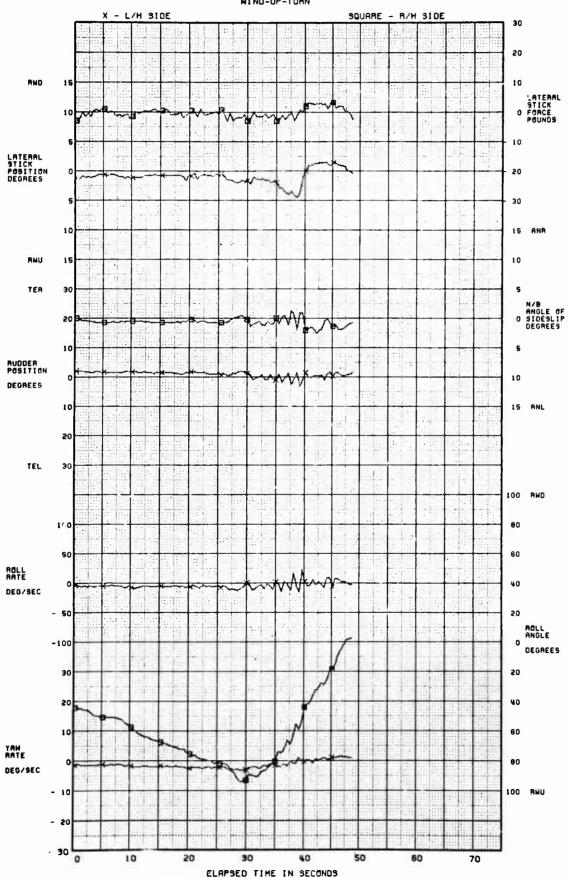


FIGURE 107 WINDUP THEN TIME HISTORY ( CONTINUED )

# FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH THO POSITION MANEUVERING SLATS

FLT 287-263 RUN 07 DATE 15 MPY 1972
F-ME MCAIR NO. 2280 USAF 3/N 66-0287
WIND-UP-TURN



FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

FLT 287-263 F-4E MUN 07 MCAIR NO. 2280 DATE 15 MAY 1972 USAF 3/N 66-0287

WIND-UP-TURN

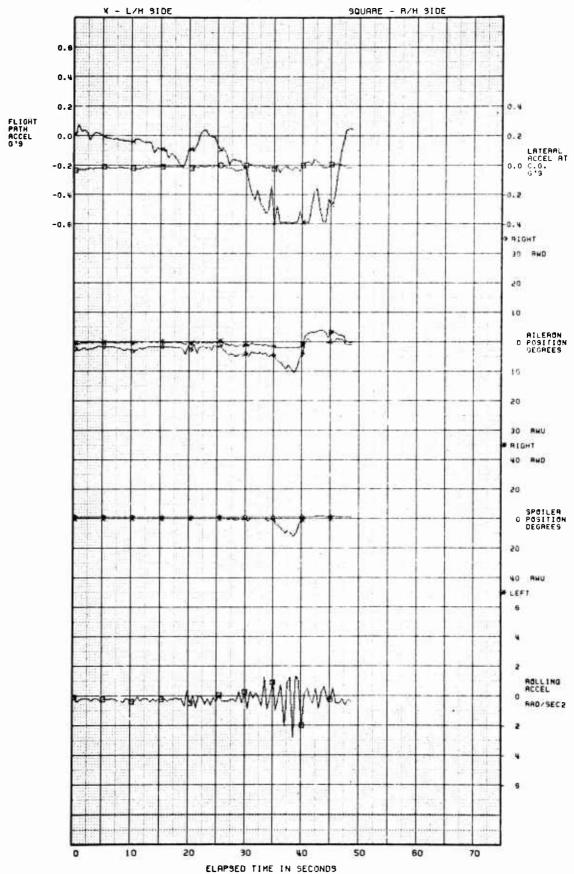


FIGURE 107 WINDUP TURN TIME HISTORY ( CONCLUDED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THE POSITION MANEUVERING SLATS

FLT 287-262

RUN 09 DATE 12 MAY 1972

F-4E MCAIR NO. 2280 USAF 3/N 68-0287

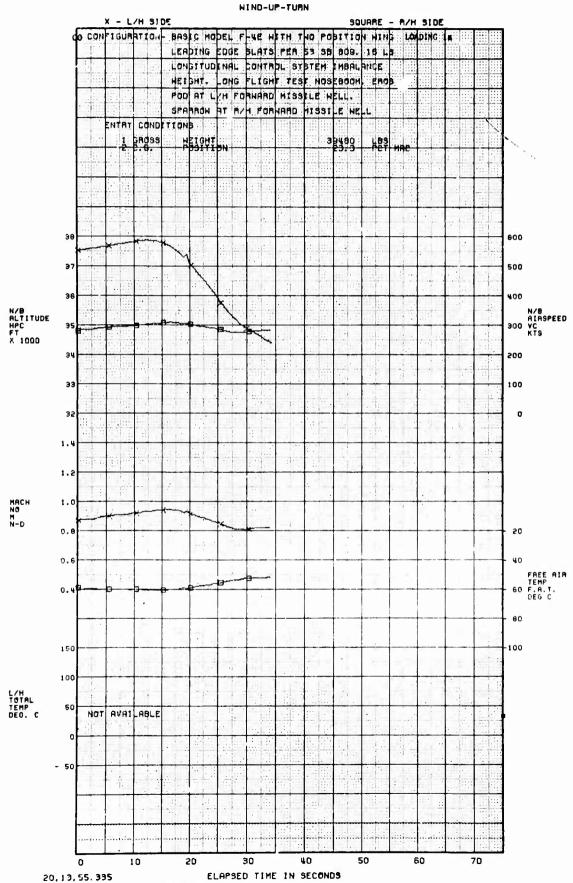
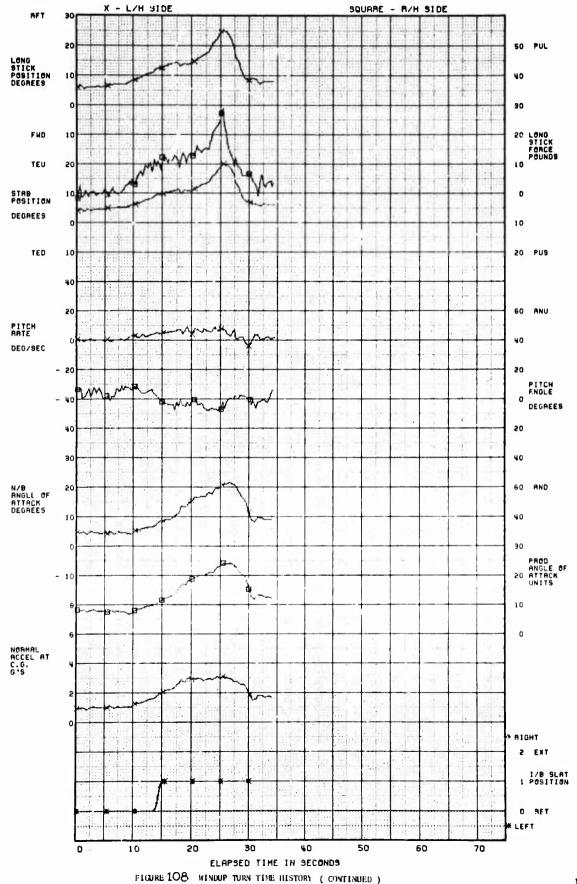


FIGURE 108 WINDUP TURN TIME HISTORY

# FLIGHT TEST EVALUATION OF THE MODEL F-4E HITH THO POSITION MANEUVERING SLATS

FLT 287-262 RUN 09 DATE 12 MAY 1972 F-4E MCRIR NO. 2260 USAF 5/N 68-0287 NIND-UP-TURN



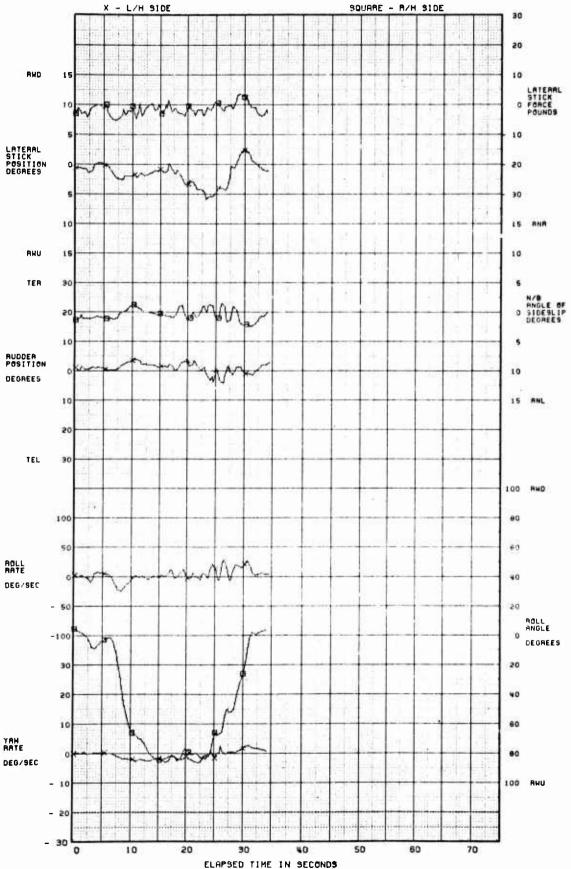
# FLIGHT TEST EVALUATION OF THE MODEL F-46 WITH THO POSITION MANEUVERING SLATS

FLT 287-262

F-4E

AUN 09 MCAIR NO. 2280 DATE 12 MAY 1972 USAF 3/N 66-0287

HIND-UP-TURN



### FLIGHT TEST EVALUATION OF THE MODEL F-4E

NITH THE POSITION MANEUVERING SLATS FLT 287-262 AUN D9 DATE 12 MAY 1972 MCRIR NO. 2280 USAF 3/N 66-0287 WIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE FLIGHT PATH ACCEL G'9 -0.4 0.4 -0.6 P RIOHT 30 RMD 50 AILERON O POSITION DEGREES 10 20 30 RHU RIGHT NO RHD 20 40 AHU LEFT O RAD/SEC2

> ELAPSED TIME IN SECONDS FIGURE 108 WINDUP TURN TIME HISTORY ( CONCLUDED )

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## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-263

RUN 08

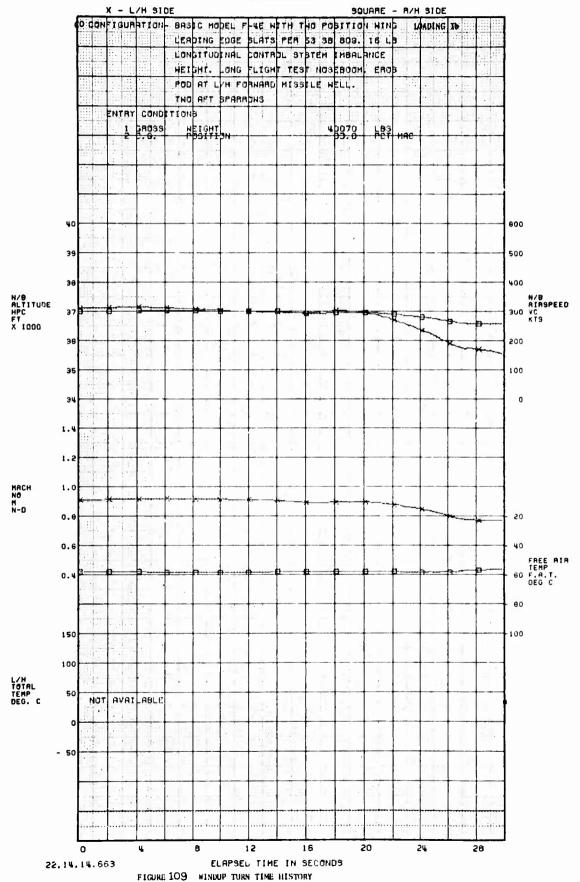
DATE 15 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 68-0287

HIND-UP-TURN



# FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THE POSITION MANEUVERING SLATS

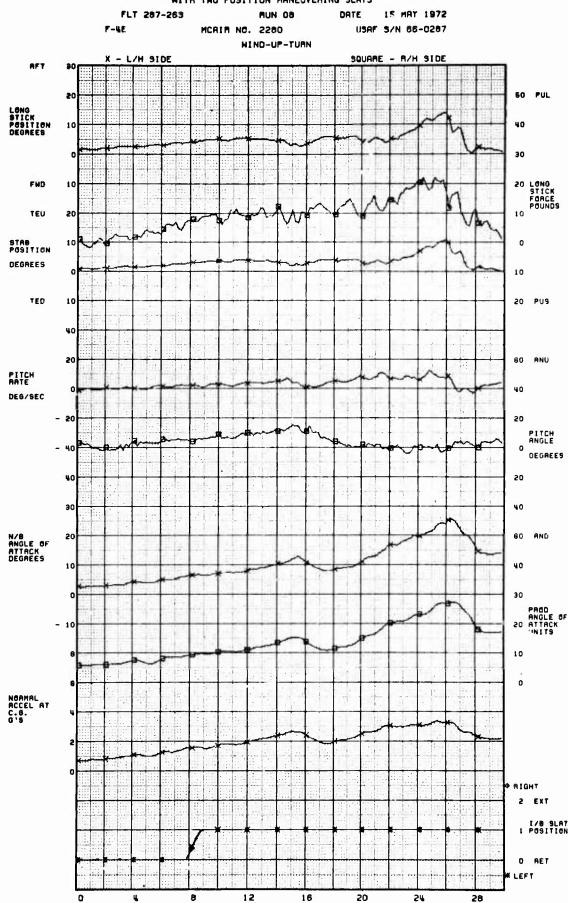


FIGURE 109 WINDUF TURN TIME HISTORY ( CONTINUED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THE POSITION MANEUVERING SLATS

FLT 287-263

RUN D8

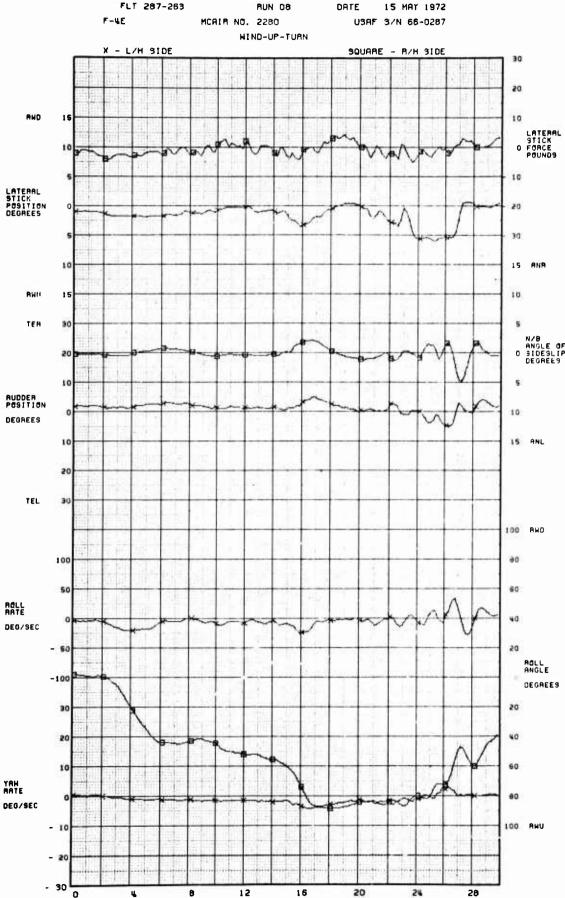


FIGURE 109 WINLUP TURN TIME HISTORY ( CONTINUED )

ELAPSED TIME IN SECONDS

## FLIGHT TEST EVALUATION OF THE MODEL F-4C WITH THO POSITION MANEUVERING SLATS

FLT 287-263

AUN OB

DATE 15 MAY 1972

F-4E

MCRIR NO. 2280

USAF 3/N 66-0287

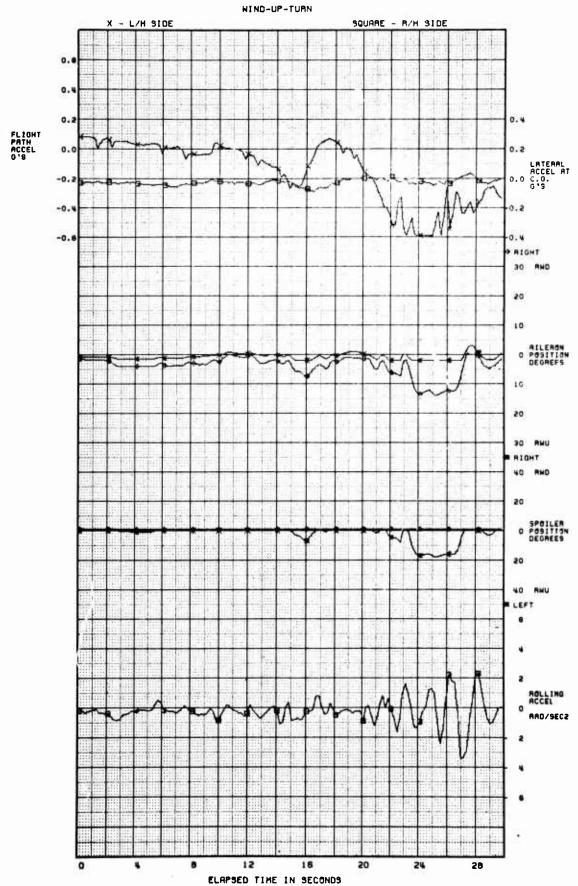


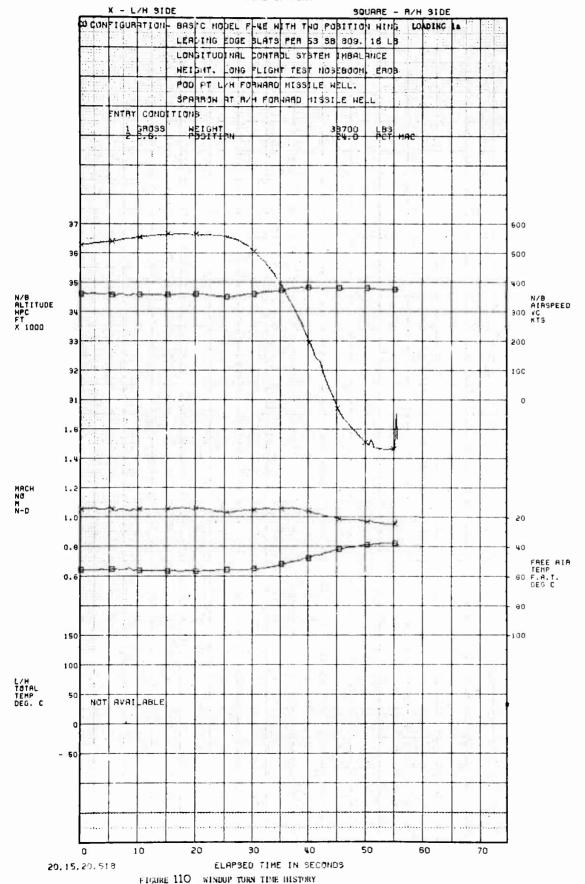
FIGURE 109 WINDUP TURN TIME HISTORY ( CONCLUDED )

# FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-262

MUN 11 MCRIM NO. 2280 DATE 12 MAY 1972 USAF 3/N 66-0287

HIND-UP-TURN



# FLIGHT FEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

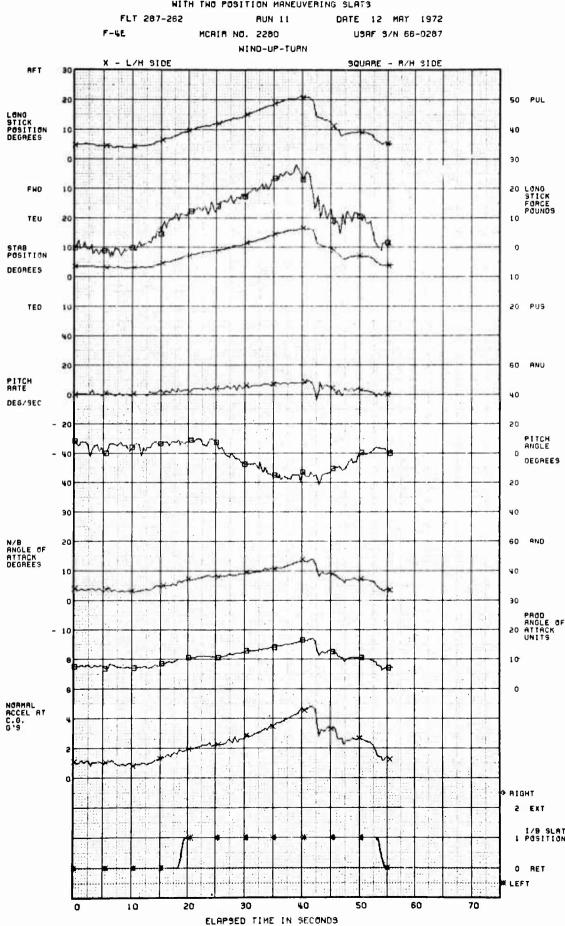


FIGURE 110 WINDUP TURN TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

FLT 287-262 F-4E BUN 11

DATE 12 MAY 1972 USAF 3/N 66-0287

NIND-UP-TURN

MCRIR NO. 2280

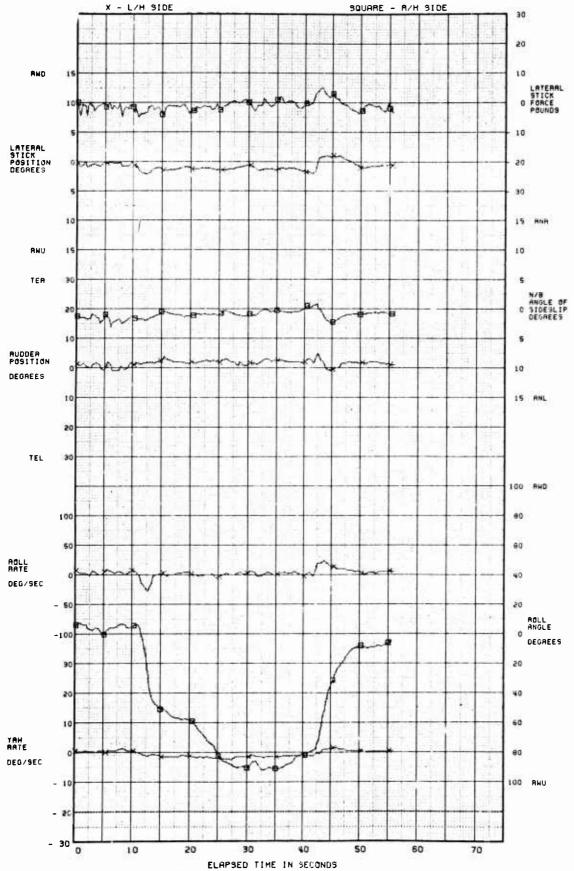


FIGURE 110 WINDUP TURN TIME HISTORY ( CONTINUED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

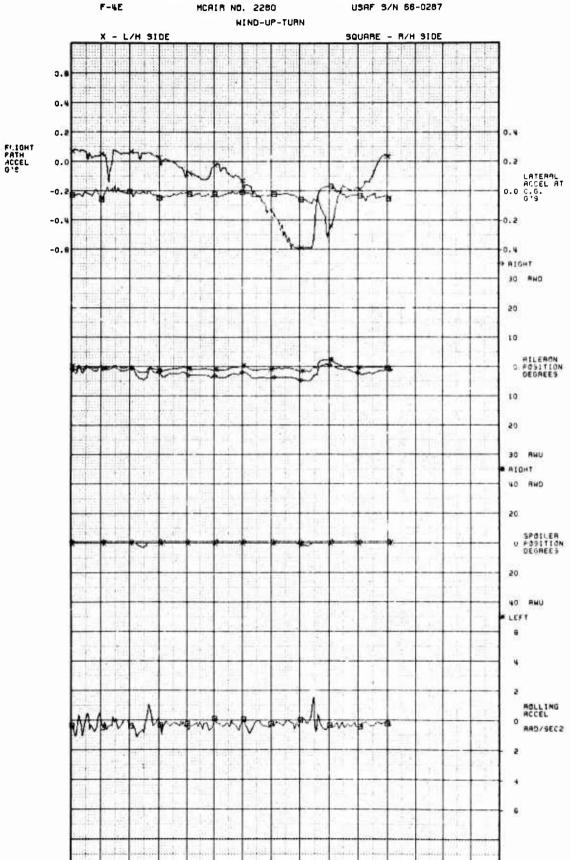
FLT 287-262

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**RUN 11** 

DATE 12 MAY 1972



## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

FLT 287-263

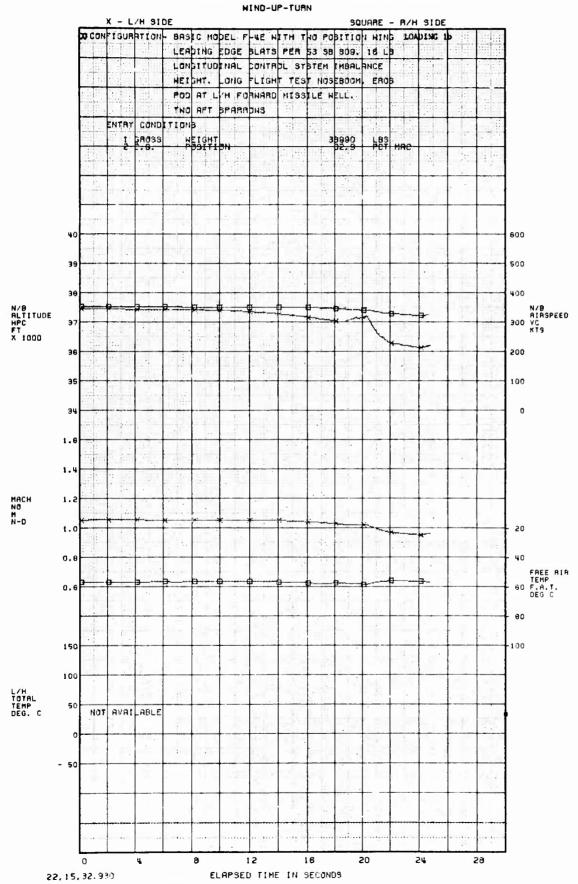
BUN 10

DATE 15 MAY 1972

F-WE

MCRIR NO. 2280

USRF 3/N 66-0287



### FLIGHT TEST EVALUATION OF THE MODEL F-4E

NITH THO POSITION MANEUVERING SLATS FLT 287-263 RUN 10 DATE 15 MAY 1972 F-4E MCRIR NO. 2280 USAF S/N 66-0287 NIND-UP-TURN X - L/H SIDE SQUARE - R/H SIDE 50 PUL э0 20 LONG 9TICK FORCE POUNDS FWD TEU STAB POSITION 0 DEGREES 10 TEO 20 PUS 60 ANU PITCH BATE DEG/SEC DEGREES N/B ANGLE OF ATTACK DEGREES 60 AND 10 NORMAL ACCEL AT C.G. G'S HIGHT 1/B SLAT 1 POSITION O RET 12

ELAPSED TIME IN SECONDS

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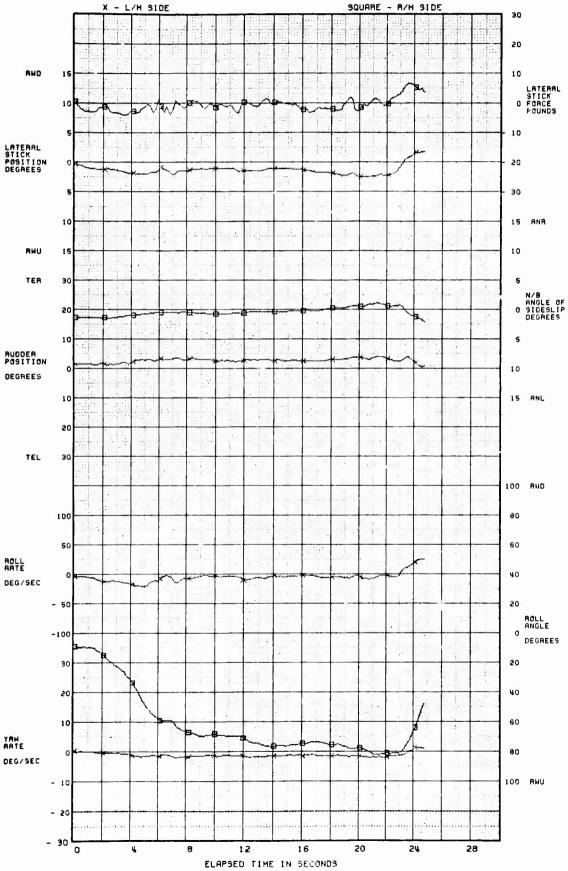
## FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH TWO POSITION MANEUVERING SLATS

FLT 287-263 F-4E BUN 10

MCAIR NO. 2280

DATE 15 MAY 1972 USAF 3/N 68-0287

WIND-UP-TURN



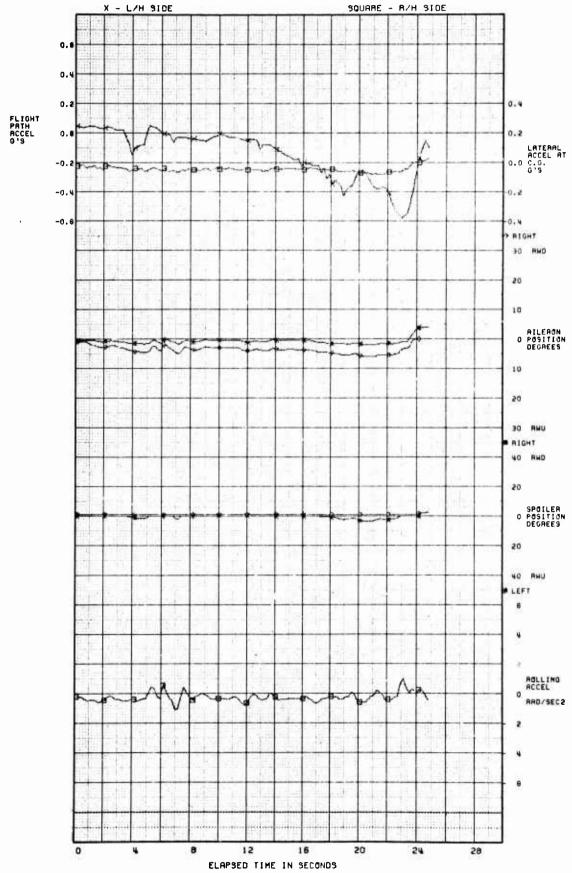
#### FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-263 F-4E

MUN 10 DATE 15 MAY 1972 USAF 3/N 66-0287

WIND-UP-TURN

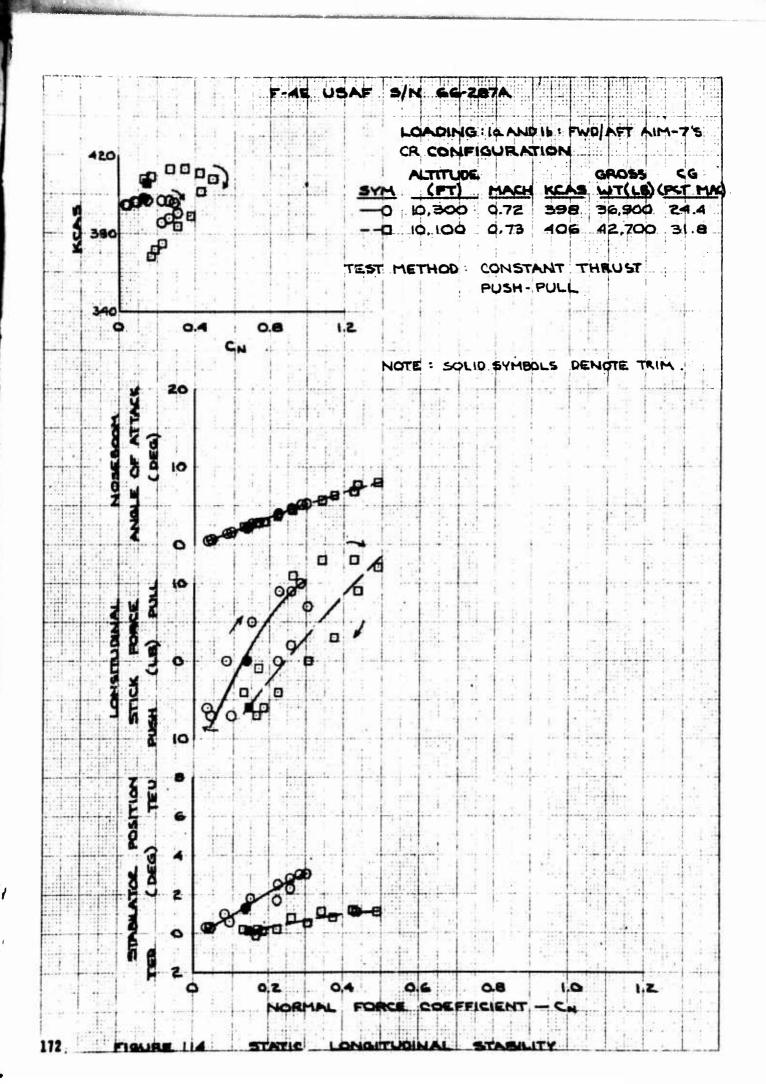
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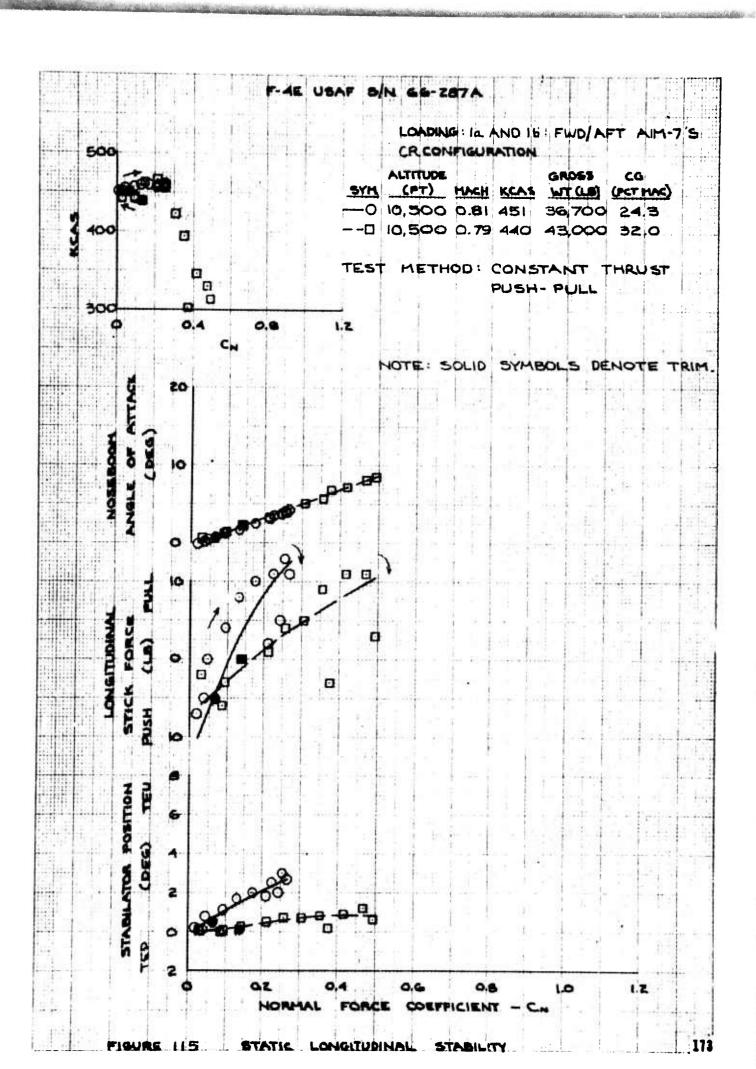


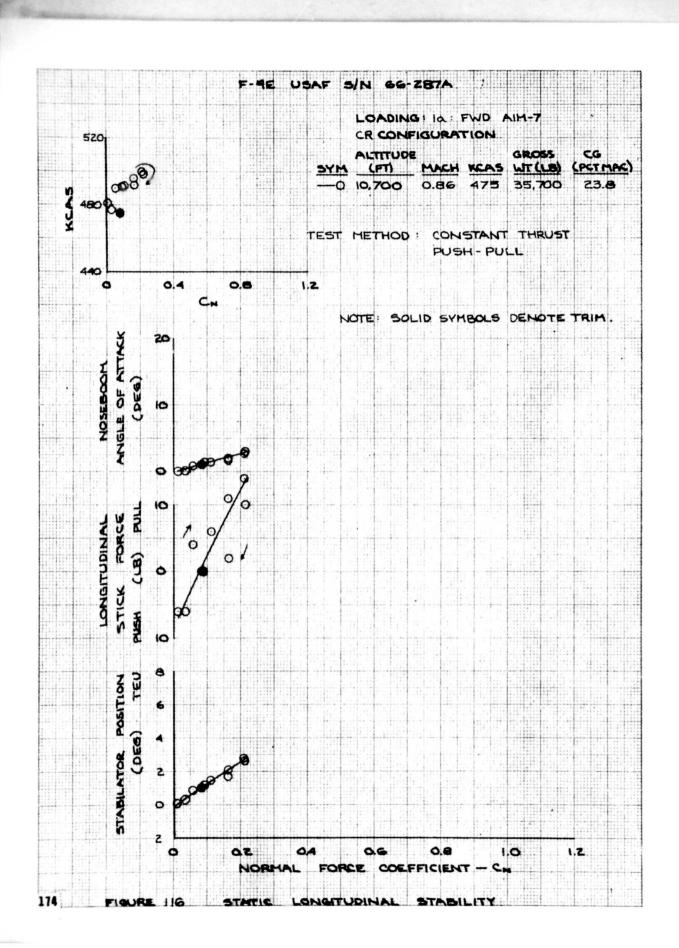
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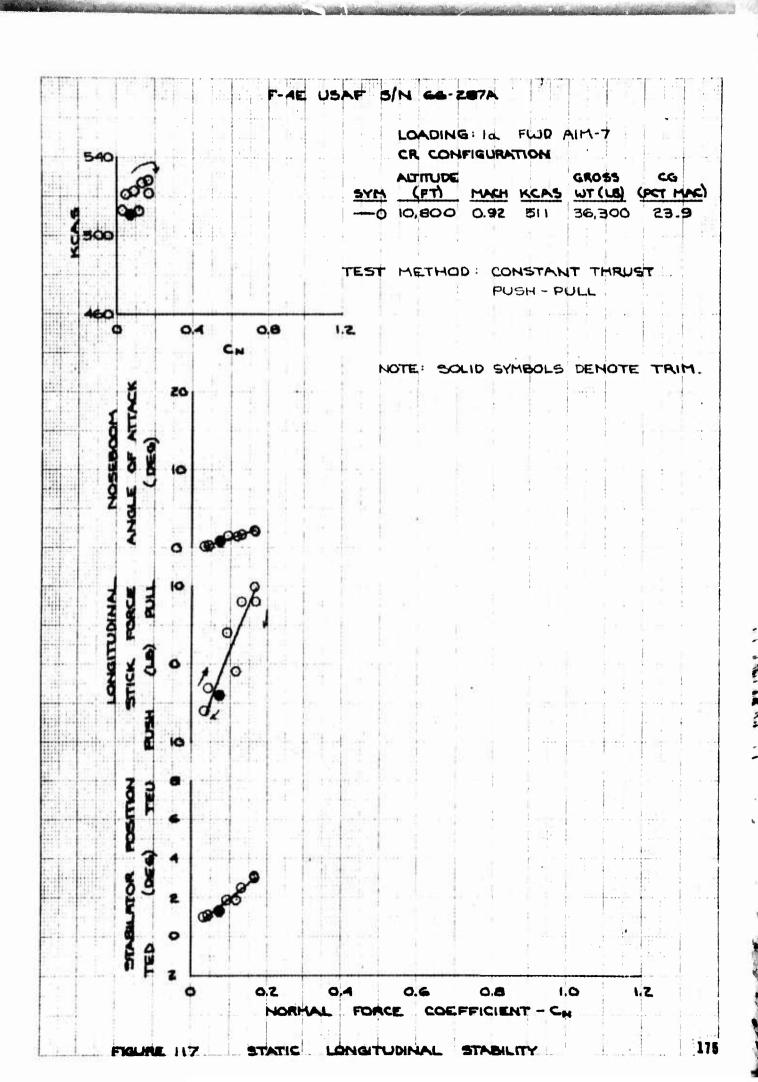
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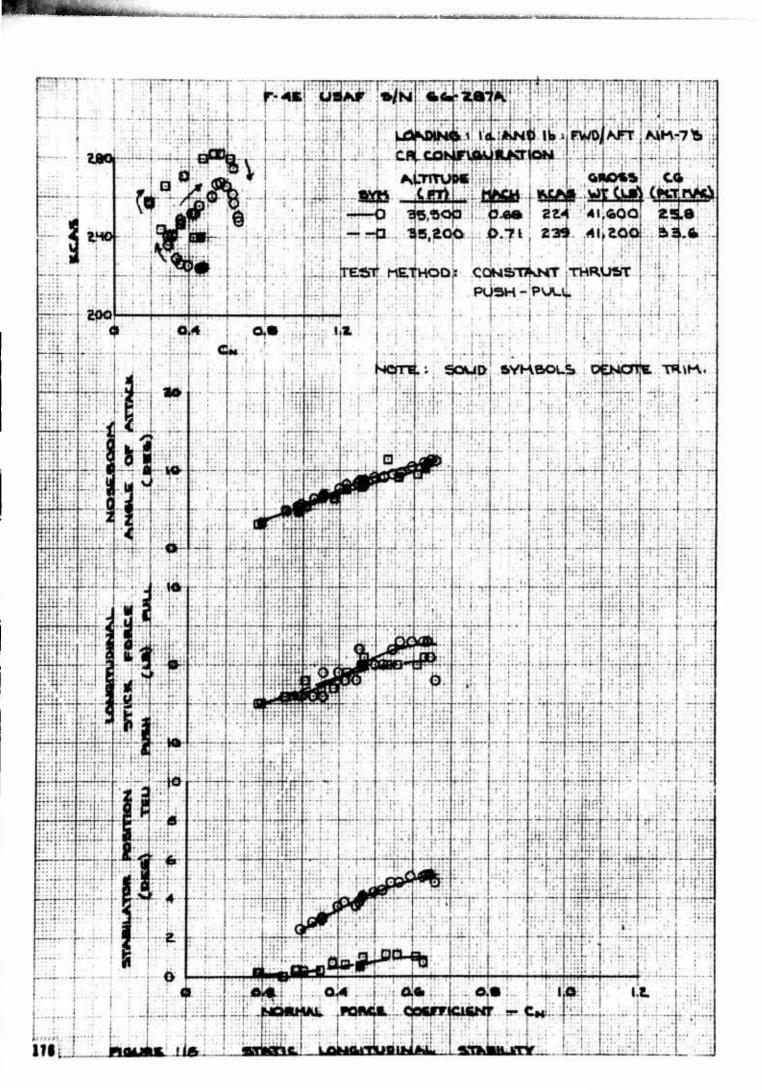
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	o	35,400	40,500	24.1	287			
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		35,100	36,500	29.7	379			
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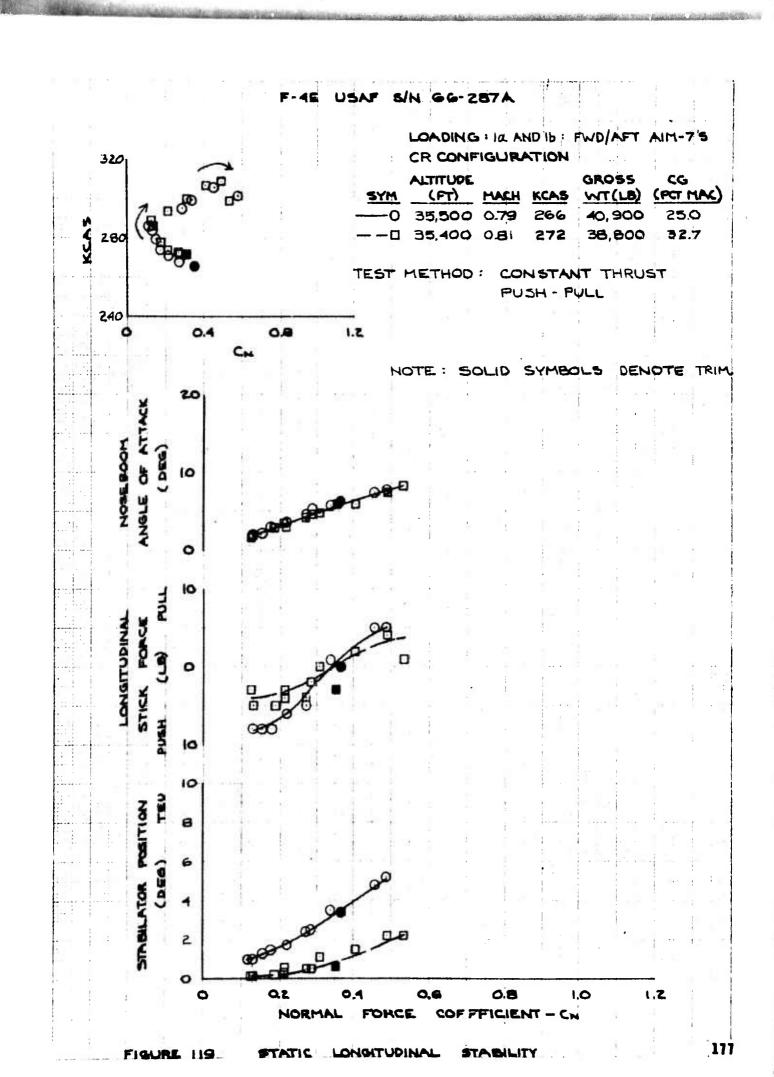


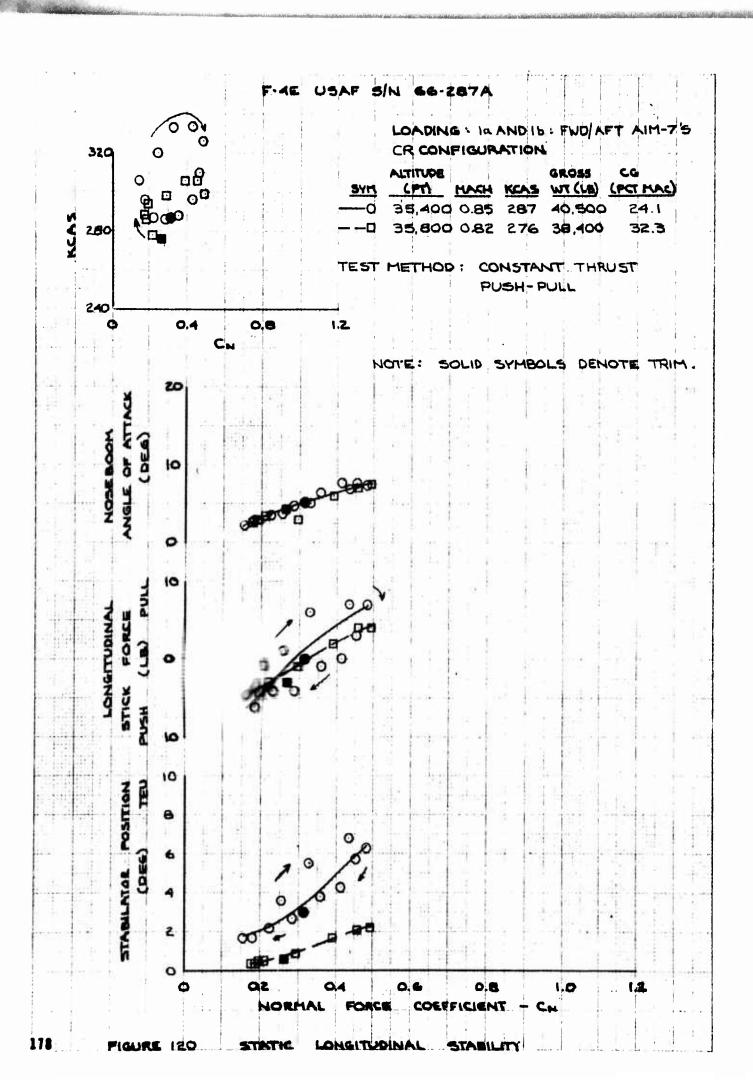


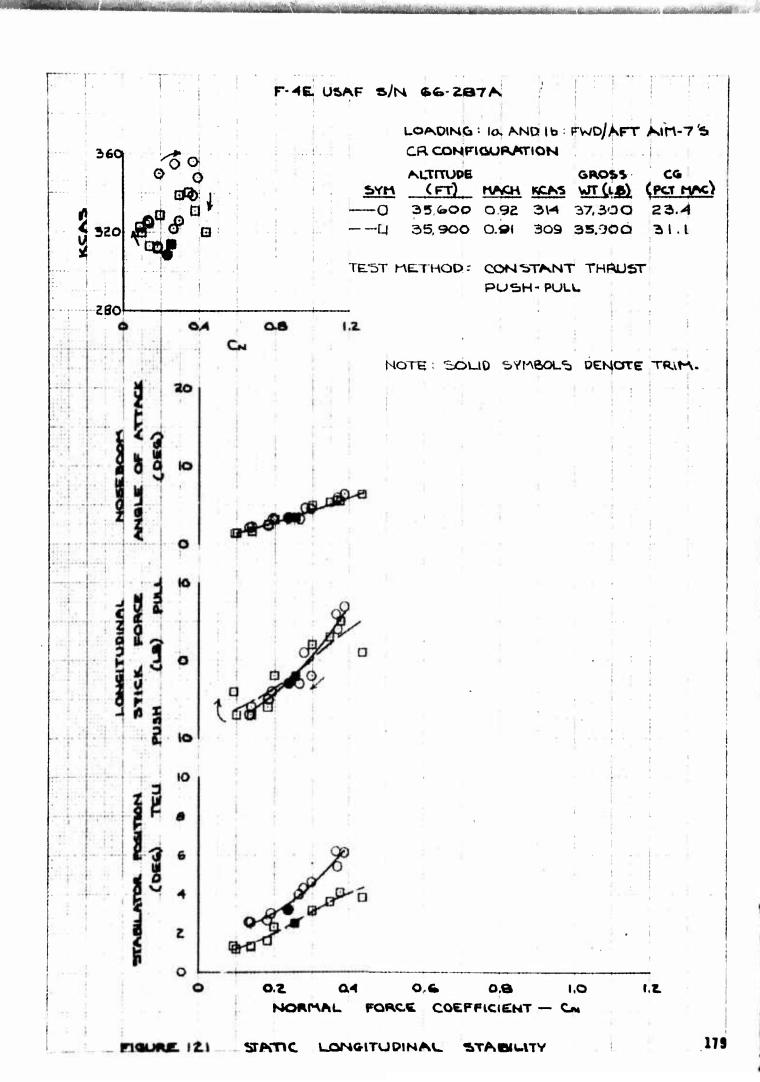


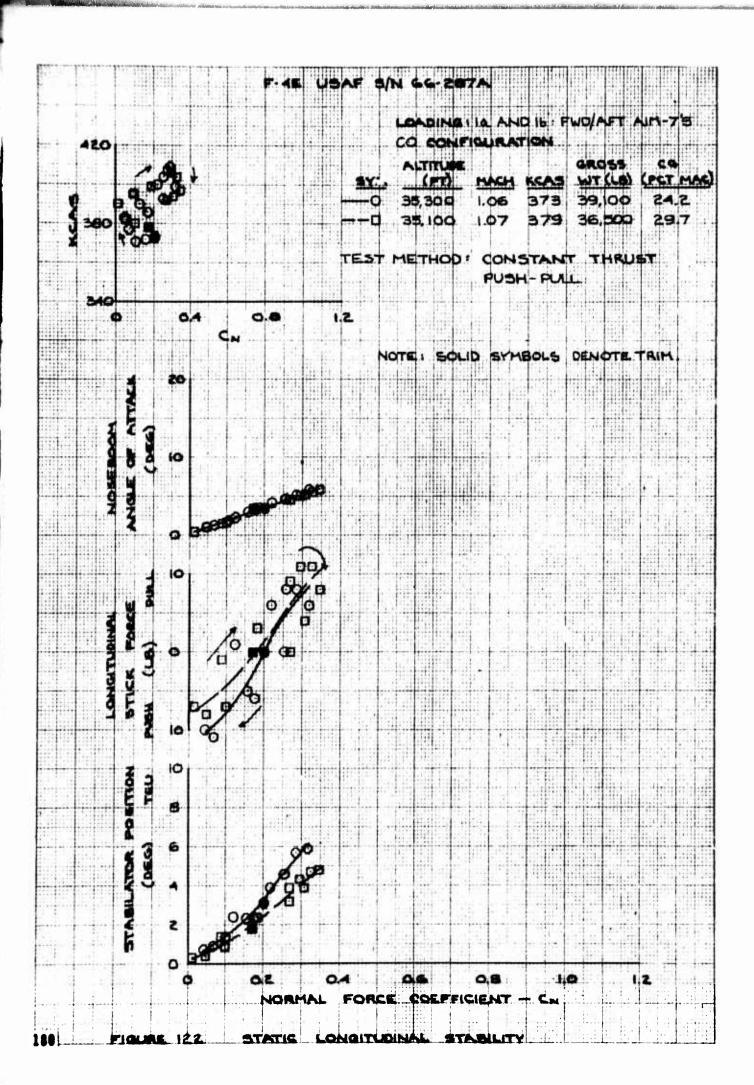


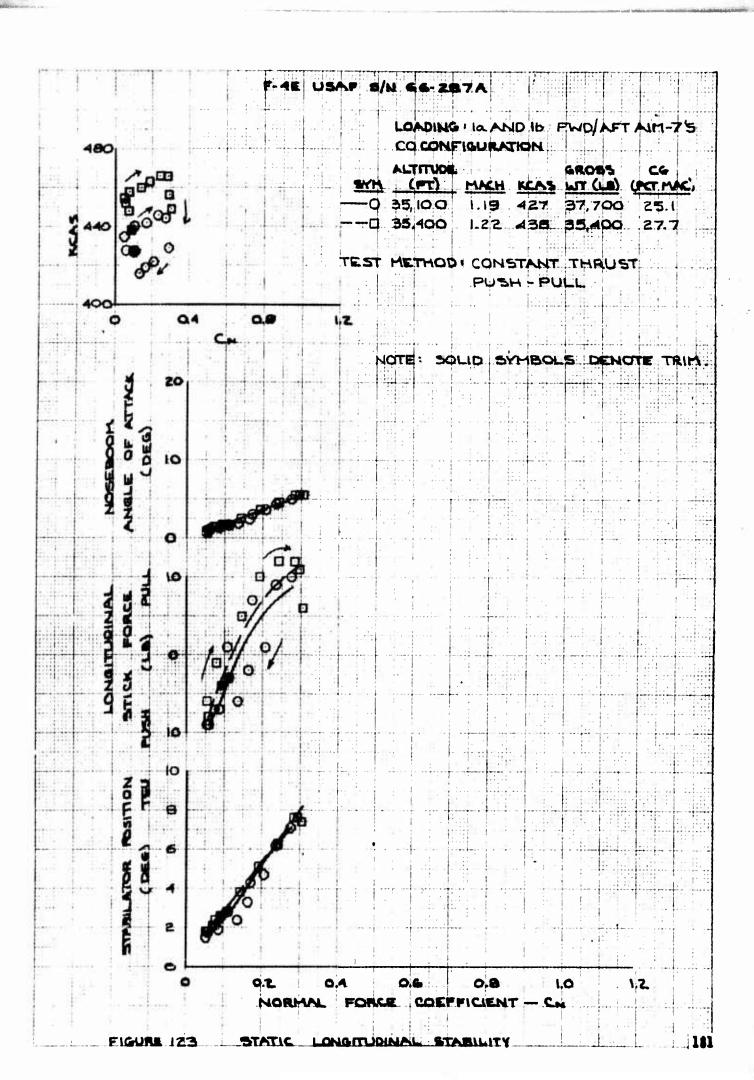


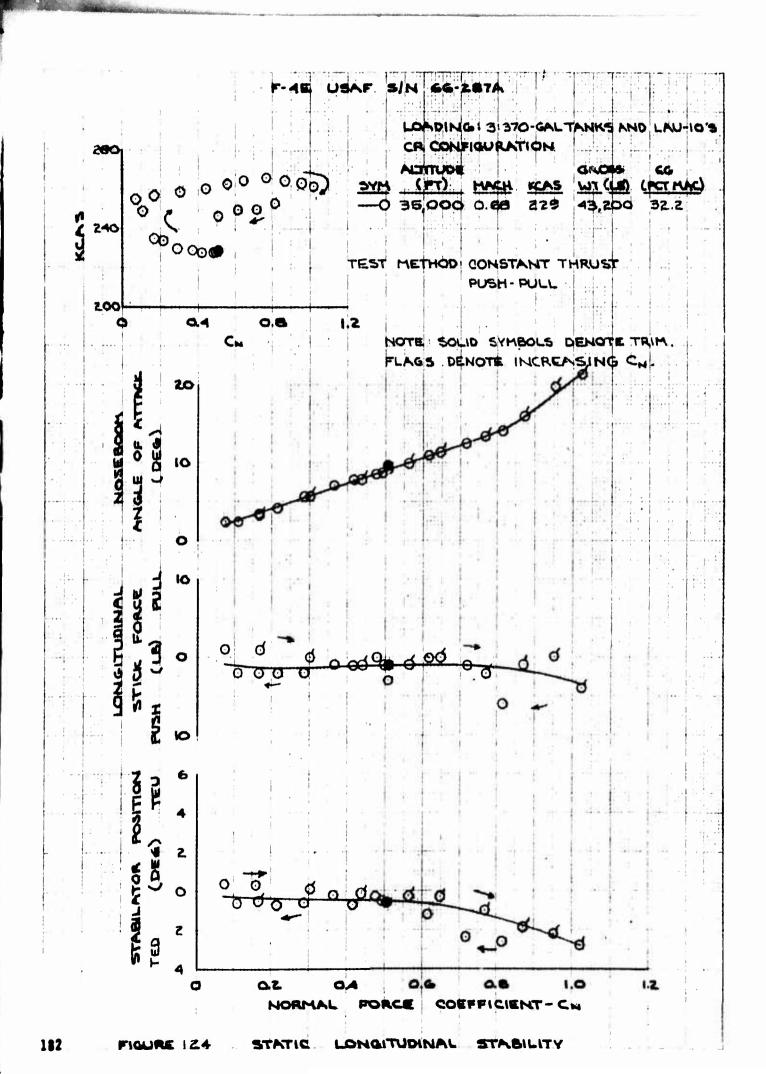


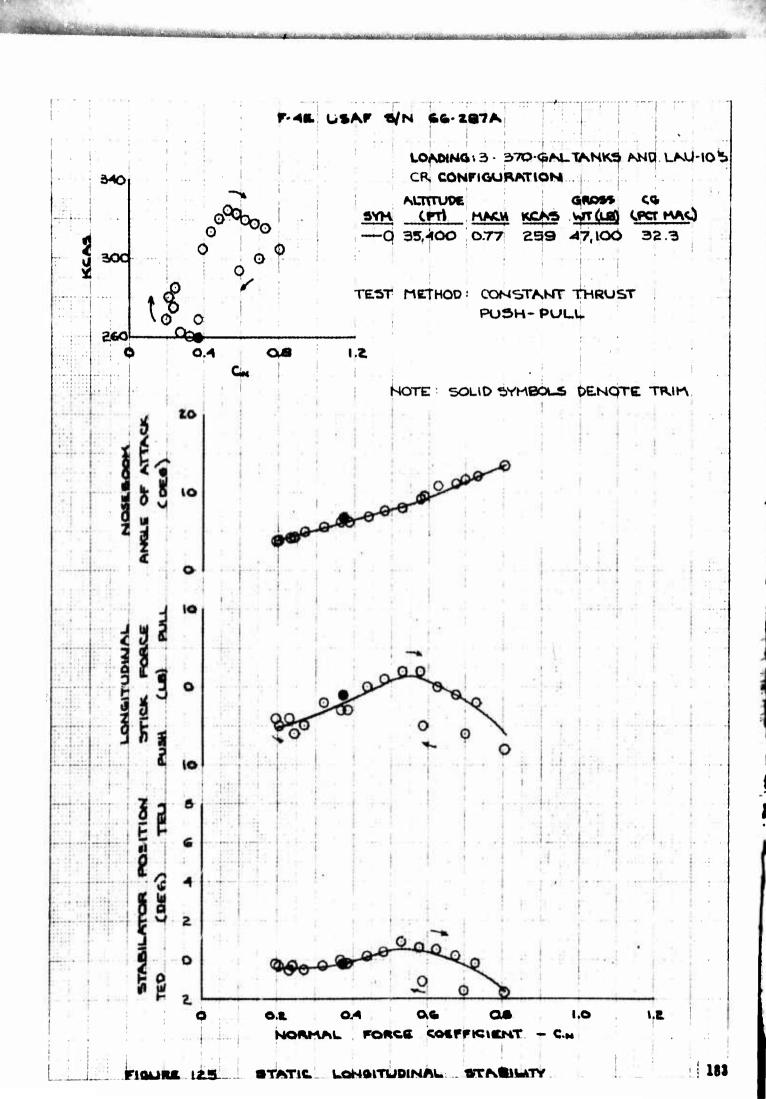


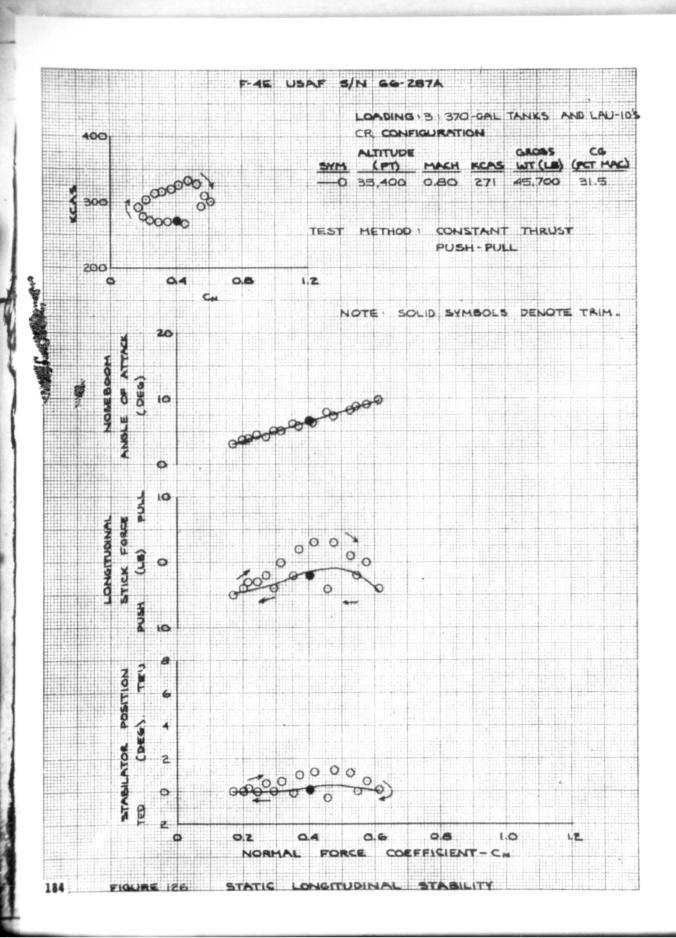


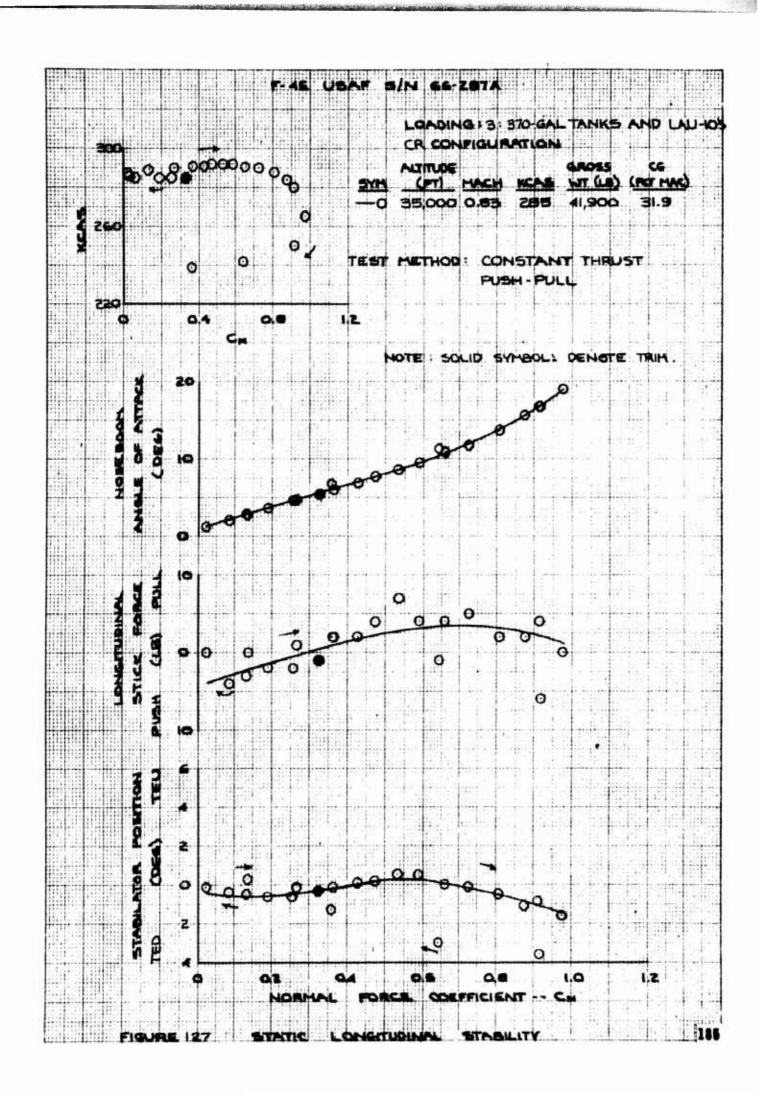


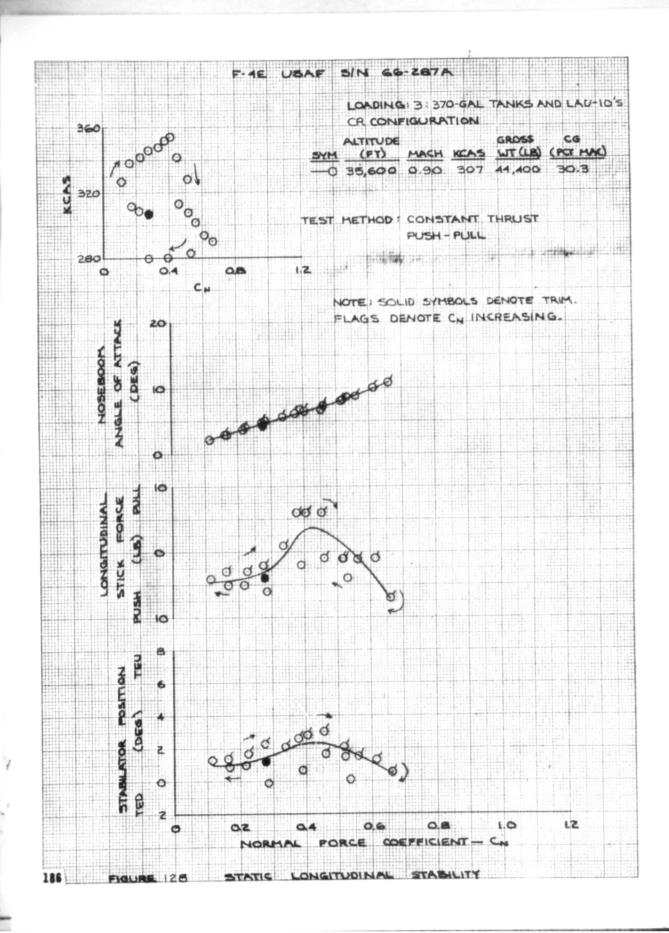


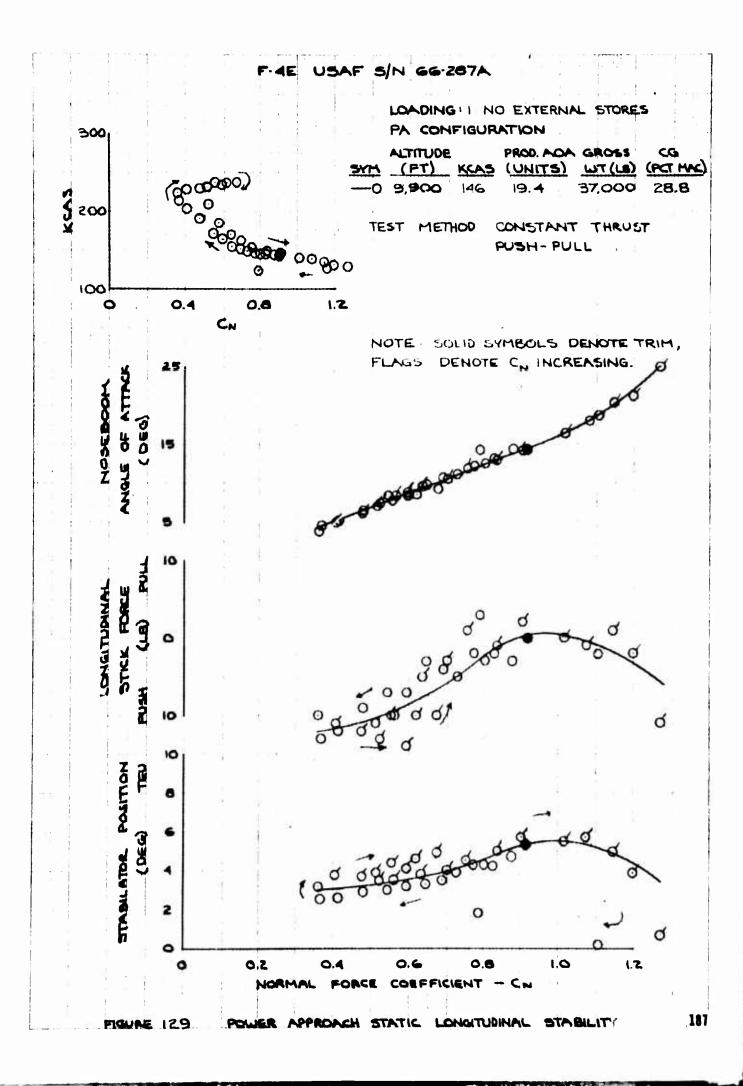


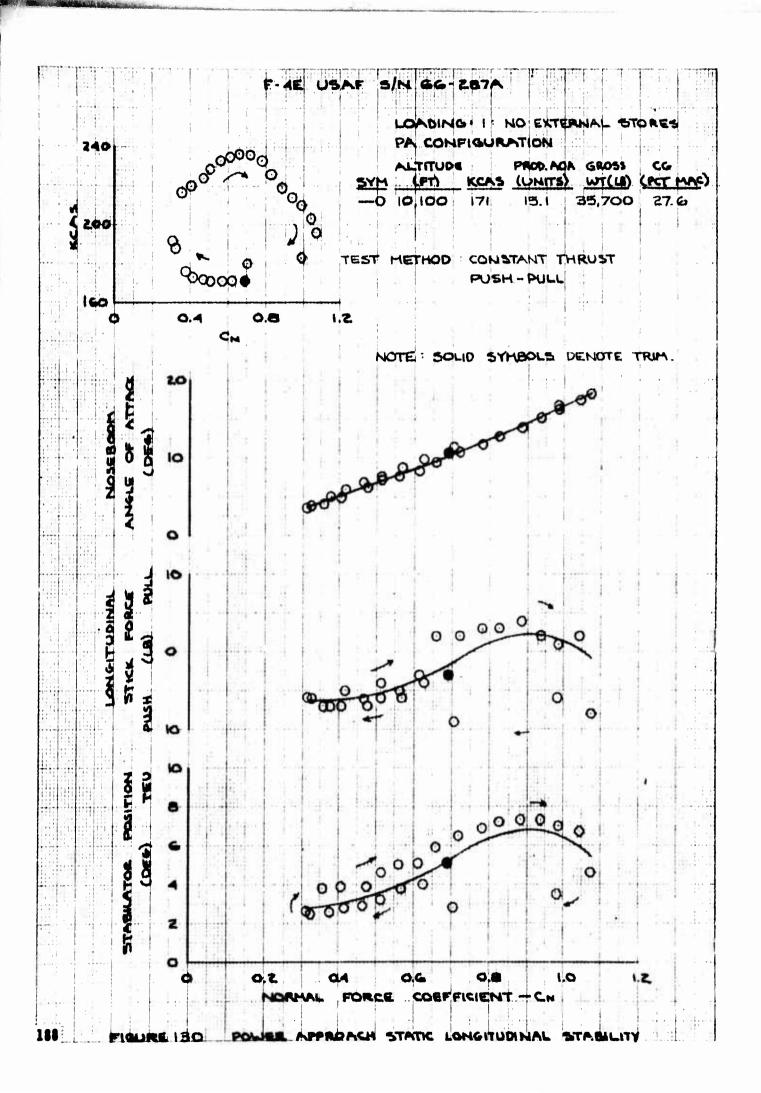












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#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MAHEUVERING SLATS

FLT 287-256

**RUN 13** 

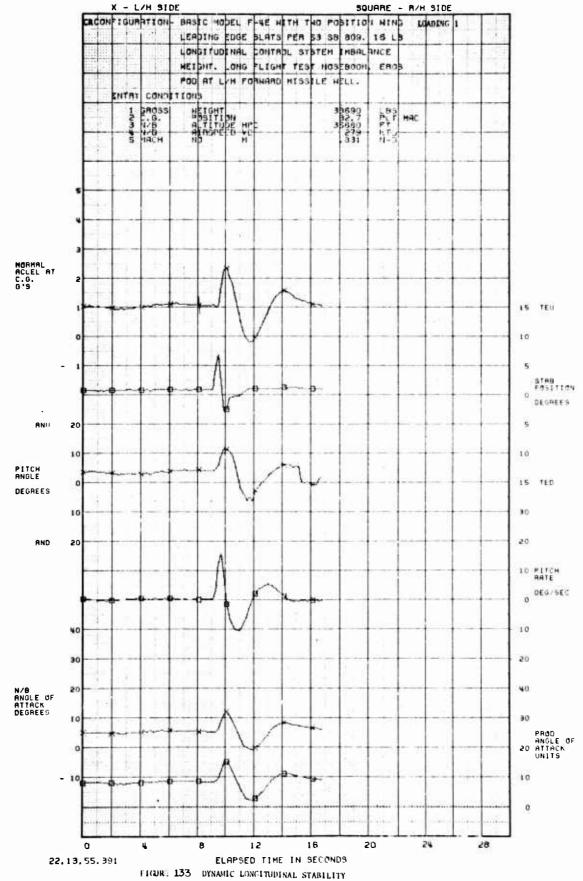
DATE 10 MAY 1972

F-4E

MCRIP NO. 2003

USAF 3/N 56-0287

DYNAMIC LONGITUDIN V STABILITY (SAS ON)



191

PAGE 01

SDE FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS DATE 10 MAY 1972

FLT 287-256

F-4E

**RUN 14** 

USAF 3/N 66-0287

MCAIR NO. 2280 DYNAMIC LONGITUDINAL STABILITY (SAS OFF)

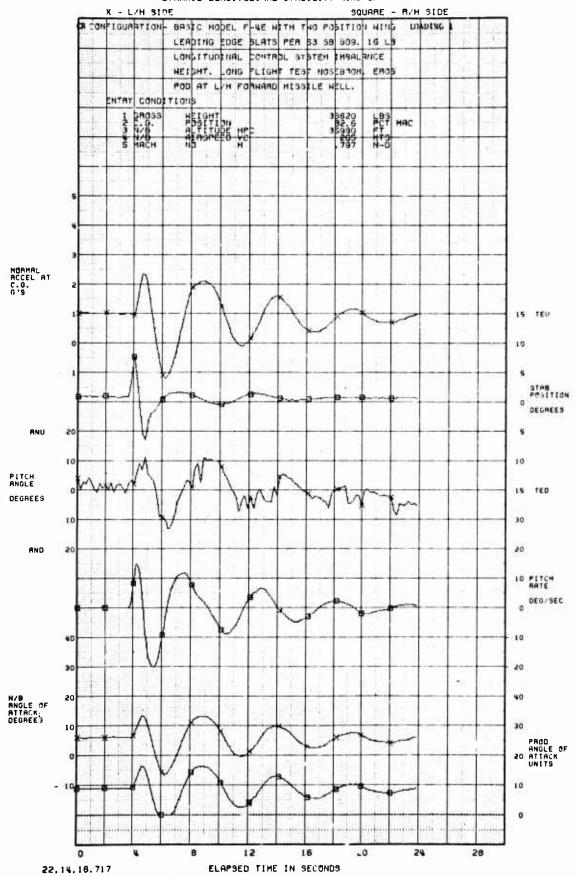


FIGURE 134 DYNAMIC LONGITUDINAL STABILITY

# FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THE POSITION MANEUVERING SLATS

FLT 287-256

RUN 23

DATE 10 MAY 1972

F-4E

MCRIR NO. 2280

USAF 3/N 66-0287

DYNAMIC LONGITUDINAL STABILITY (SAS ON) X - L/H SIDE SQUARE - R/H SIDE LOADING 1 CONFIGURATION BASIC NODEL F-4E WITH THE POSITION HING LEADING EDGE BLATS PER 53 38 809. 16 LB LONGITUDINAL CONTADE SYSTEM MEALANCE HEIGHT. LONG FLIGHT TEST NOSEBOON, ENOB POD AT L'H FORNARD MISSILE HELL. CONDITIONS NTRY 1 58055 2 C.G. 3 N.B 1 1/8 5 MACH 15 TEU STAB POSITION DEGREES ANU 10 10 15 TED DEGREES 10 AND 20 20 10 PITCH BATE DEG/SEC 40 10 30 20 N/B ANGLE OF ATTACK DEGREES 20 40 10 30 2.0 4.0 5.0 6.0 7.0 0.0

ELAPSED TIME IN SECONOS

FIGURE 135 DYNAMIC LONGITUDINAL STABILITY

22, 18, 43, 461

APPROVAL, DATE DE

SDE

SETE

PAGE 01

FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

FLT 287-256

BUN 24

DATE 1C MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

DYNAMIC LONGITUDINAL STABILITY (SAS OFF)

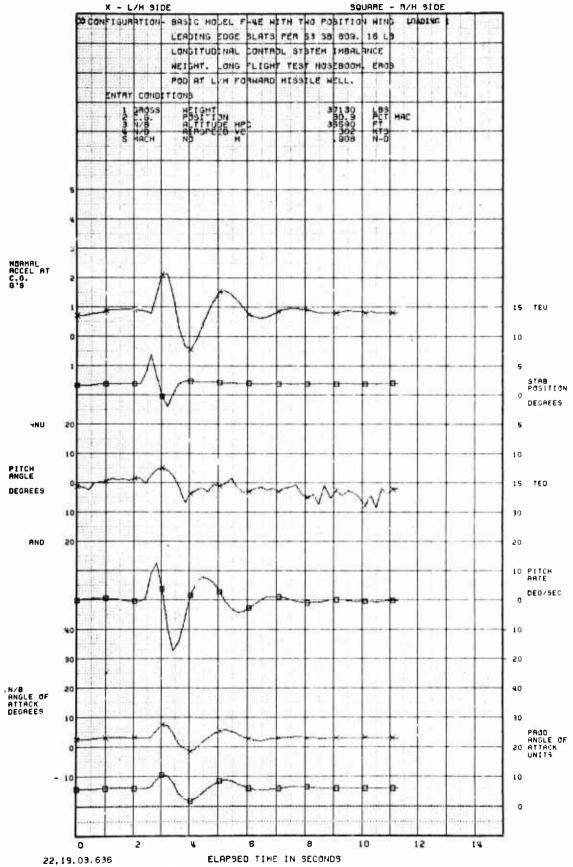


FIGURE 136 DYNAMIC LONGITUDINAL STABILITY

### FLIGHT TEST EVALUATION OF THE MODEL F-4E HITH THO POSITION MANEUVERING SLATS

FLT 287-258

RUN 27

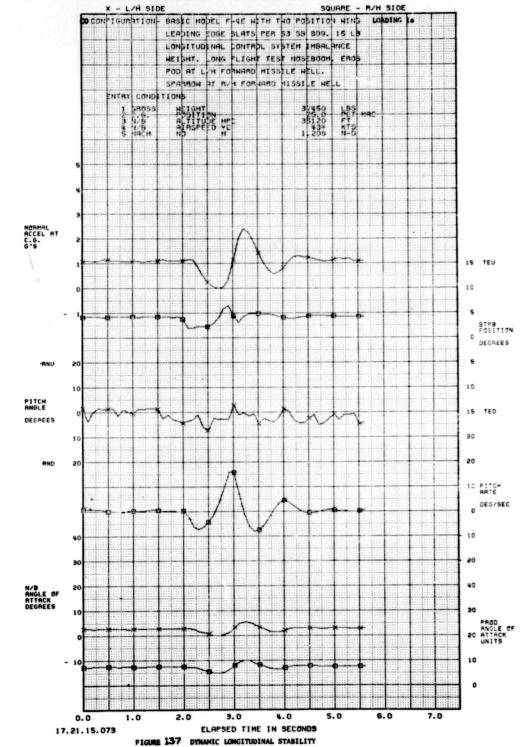
DATE 11 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

DYNAMIC LONGITUDINAL STABILITY (SAS ON)



### FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS

FLT 287-258

RUN 28

DATE 11 MAY 1972

F-4E

MCAIR NO. 2280

USAF S/N 66-0287

DYNAMIC LONGITUDINAL STABILITY (SAS OFF)

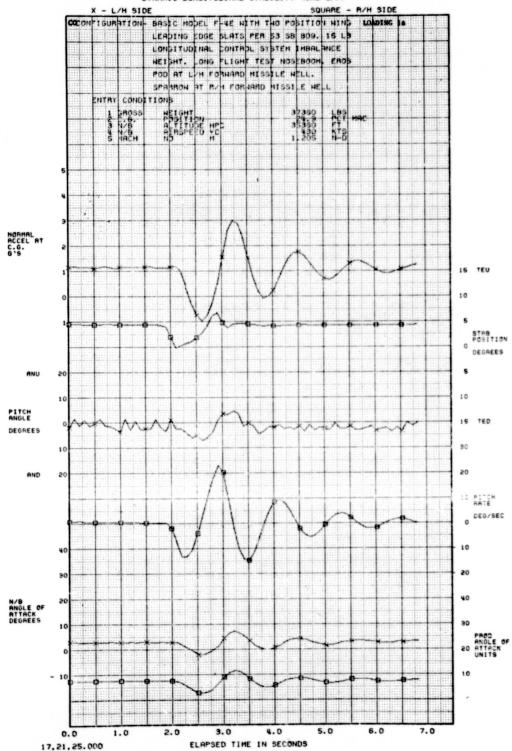


FIGURE 138 DYNAMIC LONGITUDINAL STABILITY

APPROVAL, DATE DE

SDE

FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS

FLT 287-254 F-4E

MCAIR NO. 2280

DATE 9 MAY 1972 USAF S/N 66-0287

DYNAMIC LONGITUDINAL STABILITY (SAS ON)

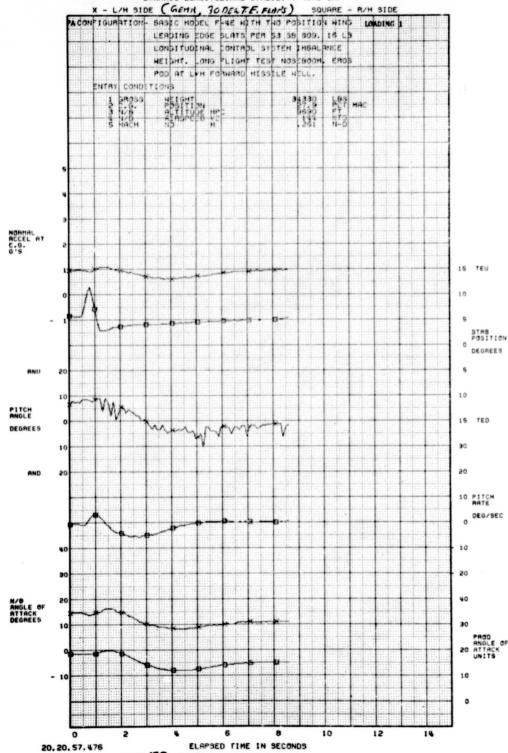


FIGURE 139 DYNAMIC LONGITUDINAL STABILITY

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

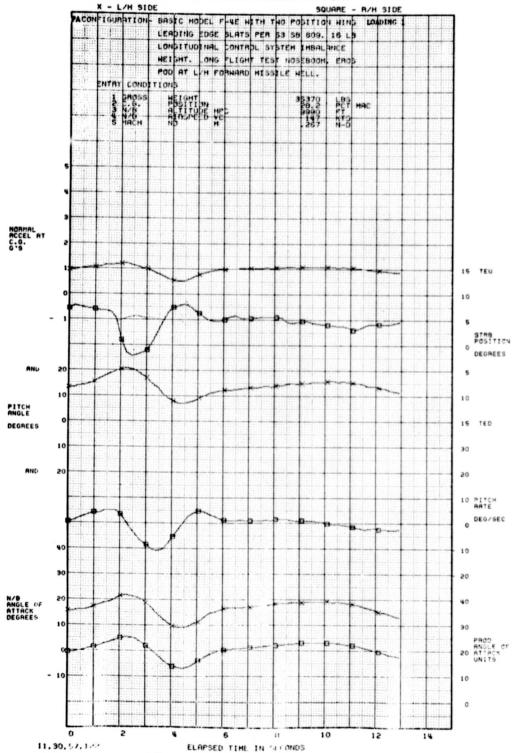
**RUN 33** 

DATE 2 MAY 1972

MCAIR NO. 2280

USAF 3/N 66-0287

M DYNAMIC LONGITUDINAL STABILITY (SAS OFF)



APPROVAL, DATE DE

SDE

SFTE

PROE 01

FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

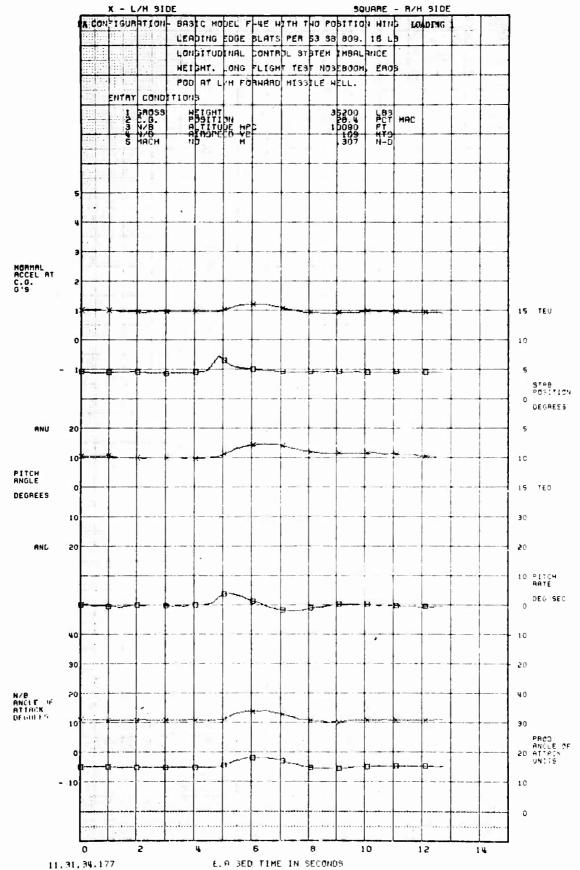
FLT 287-252

RUN 35 DATE 2 MAY 1972

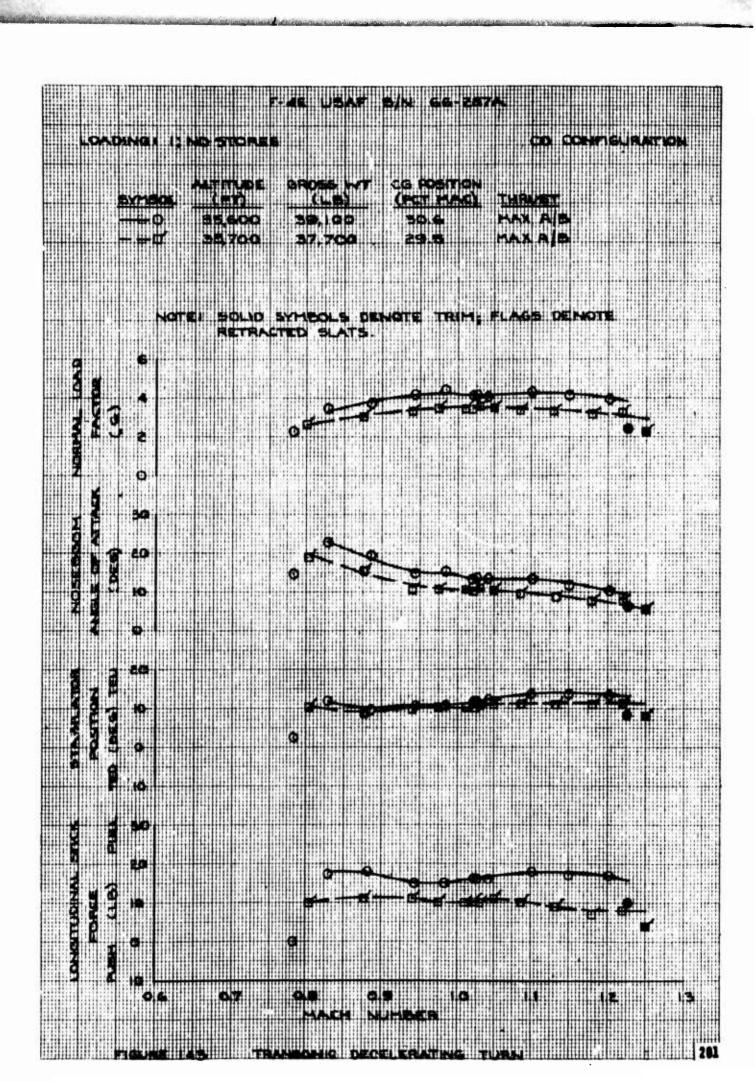
MCRIA NO. 2280

USRF 3/N 66-0287

"M"DYNAMIC LONGITUDINAL STABILITY (SAS OFF)



		7 10 3	(FT) 6,400 9,600	GROSS V (LS) 37,400 36,400	(es	POSITION T MAC 29.2 28.3	P P	IRUST WA/B		URATIO	
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	0.6		0.7	O.B TACH	0.9 NUM <b>9</b>	<b>6</b> A	6	. <b>H</b>	47	-	3



# FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH TWO POSITION MANEUVERING SLATS

FLT 287-273

RUN 18

DATE 24 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

A/B POWER ACCELERATION

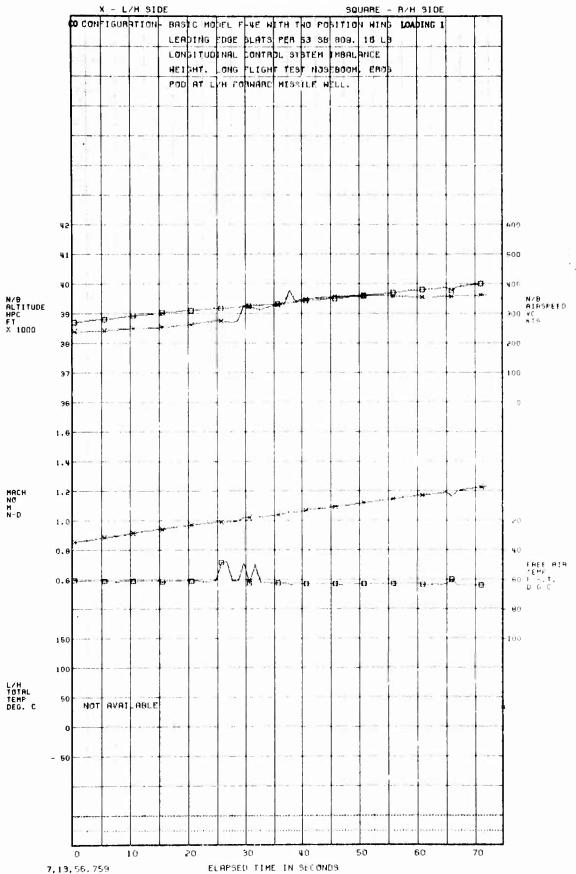


FIGURE 144 MAX A/B THRUST ACCELERATION TIME HISTORY

## FLIGHT TEST EVALUATION OF THE MODEL F-WE WITH THE POSITION MANEUVERING SLATS

FLT 287-273 RUN 18 DATE 24 MAY 1972 MCAIR NO. 2280 USAF 3/N 66-0287 A/B PONER ACCELERATION X - L/H SIDE SQUARE - R/H SIDE AF I 30 50 PUL 50 LONG STICK POSITION DEGREES 40 30 20 LONG 9TICK FORCE POUNDS FWD TEU STAB POSITION DEGREES 10 TED 10 .40 60 ANU 20 PITCH BATE 40 DFG/9EC - 20 Ö DEGREES 40 20 N/B ANGLE OF ATTACK DEGREES 60 AND 20 10 NORMAL ACCEL AT C.G. G'S 0 RET 0 10 60 ELAPSED TIME IN SECONDS

· 一一一一一一一

FLT 287~273

**BUN 21** 

DATE 24 MAY 1972

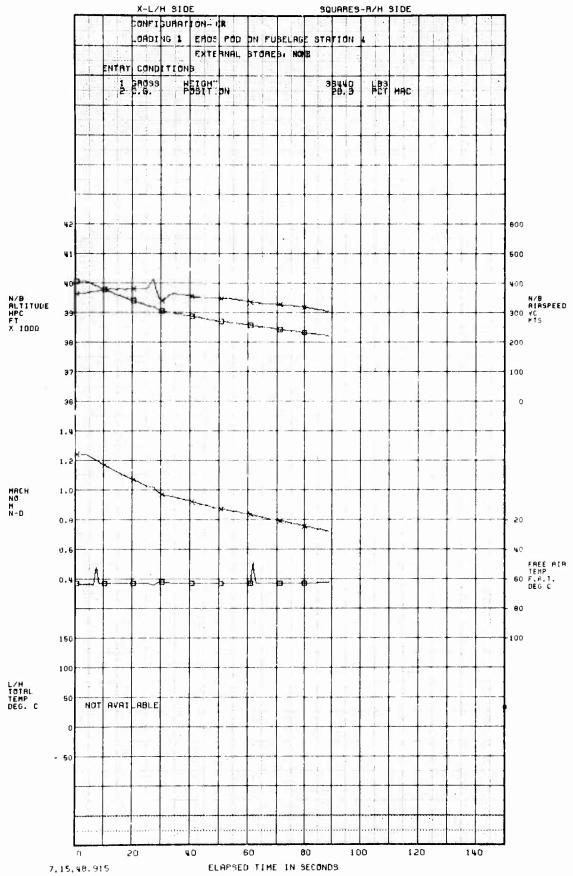


FIGURE 145 IDLE THRUST DECELERATION TIME HISTORY

FLT 287-273

**RUN 21** 

DATE 24 MAY 1972

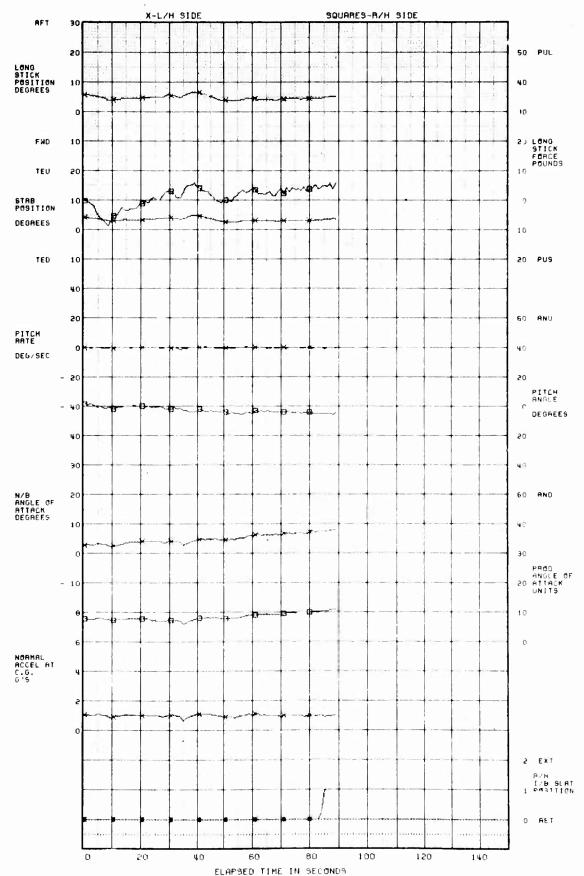


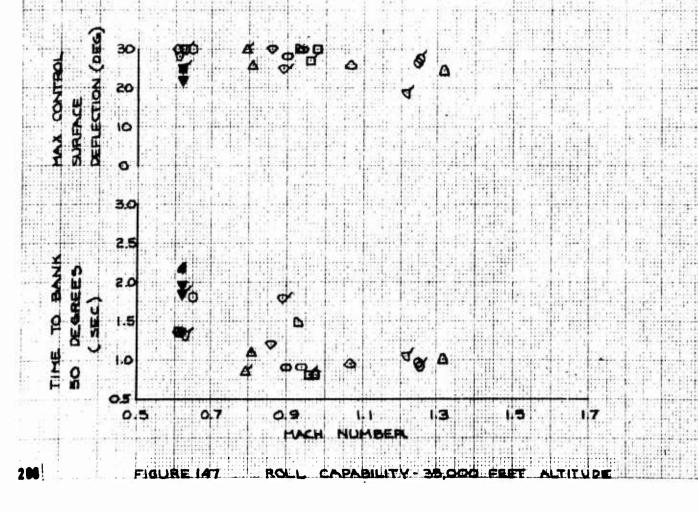
FIGURE 145 IDLE THRUST DECELERATION TIME HISTORY ( CONCLUDED )

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4	8 g	<b>4 6 1</b>	10,700 10,000 11,500 10,100 9,900 10,409 12,400 9,900	10,400 10,500 10,500 10,500 10,500 10,300 10,700 10,400 11,500
			37, 300 37, 100 35, 500 35, 600 35, 100 35, 400 35, 500	GROSS WT (LB) 35,300 35,100 35,400 35,400 36,100 34,700 36,300 37,700
-11	7 ·	n gandaraga	24.0 24.3 24.0 27.8 28.0 28.4 24.1 29.1	26.9 26.6 29.9 26.2 27.7 26.0 26.0 29.4 25.3
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	<b>F</b>	AE USAF	5/N 66-287A				
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SYMBOL	ALTITUDE (FT)	GROSS WT	CG POSITION	PRODUCT			
O	39,700 35,700	36,600		8 6			
Δ	35,200 35,200	36,800 36,400	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	16			
0	35,600 36,900	40,600	27.1	15			
	34,300 35,600 35,300	39,700 38,200 37,100	26.5 25.6 24.3	25 28			:
<b>V</b>	34,300	36,600	24.3	20			
۵	35,500 35,400	35,000 34,800	28.6 28.5	11			
۵	35,500	34.700	27.7	. 12			.:

NOTES: PLAIN SYMBOLS DENOTE LEFT AILERON ROLLS, FLAGS DENOTE RIGHT ROLLS. SOLID SYMBOLS DENOTE RUDGER MOLLS



111	11:3 1 1	4 1 0 -			1	10.0	1 1	1 . 1	11.	1 . 4		
	T-4E	21:	U	4	Per 11	C/1		40	_ =	100	AL I	
4 4 -		3 1 1		$\mathbf{z}$		21	N	1010	\- a	.0/		

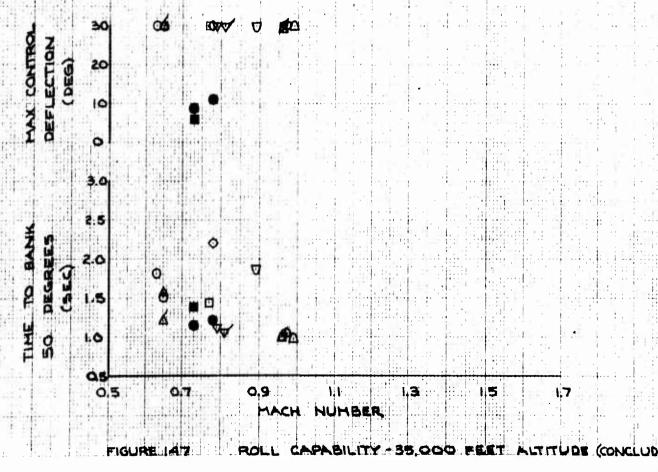
LOADINGS : 2: 879-GAL TANKS,

CR CONFIGURATION

SYMBOL	ALTITUDE (FT)	GROSS WT	CG POSITION	PRODUCTION	LOADING
O	34,900	42,600	27.7	13-17	3 SEE NOTE &
o o	35,100	42,100	27.0	10	3
•	34,600	42,000	27.7	23	3
<b>P</b>	35,100	40,500	26.8	7.	3 "
V	35,300	40,200	26.7	21	3
0	34,700	40,000	26.6	11	<b>3</b> (e
Δ	35,200	41,000	29.4	12	AZ SEE NOTE 3
$\nabla$	35,200	40,500	29.3	10	AZ "
Δ	35,900	40,100	29.0	6	" 5A
	35,200	39,000	27.2	26	3 SEE NOTE A
	32,400	35,800	27.0	29	3

NOTES: I.PLAIN SYMBOLS DENOTE LEFT AILERON ROLLS, FLAGS
DENOTE RIGHT ROLLS, SOLID SYMBOLS DENOTE RUDDER ROLLS.

2. EXTERNAL FUEL TANKS FULL. 3. ASYMMETRIC FUEL LOAD
AS FOLLOWS: RIGHT 370-GAL TANK HALF FULL, LEFT 370-GAL
TANK EMPTY. 4. EXTERNAL FUEL TANKS EMPTY.



SYMBOL	ALTITUDE (FT)	GROSS WIT	CG (PCT HAC)	PRODUCTION	LOADING
0	6,500	36,000	26.3	<b>is</b>	
ď	9,100	35,000 37,700	25.6 26.8	10	652A
<b>o</b>	10,100	38,200 35,700	27.I	18	A2 SH
Δ	9,900	37.500 37.200	29.3	13	
<b>A</b>	10,000	36,700	28.4	15	
		LAIN SYMBOLS			
		OSITION; SOLI NO RUDDER I		DEHOTE HOD	DER HOLL
A 30		•	<b>△</b> ▼	<b>A</b>	
a F so					
10					
		140		NETRIC FUEL WS: RIGHT	
GREES		МО	FOLLO	WS: RIGHT	370-GALT
(DEGREES)		70	FOLLO	WS: RIGHT	370-GALT
WD (DEGREES)		70	FOLLO	WS: RIGHT	370-GALT
(DEGREES)		<b>4</b> ⊙@ <b>*</b>	FOLLO	WS: RIGHT	370-GALT
WD (DEGREES)			FOLLO HALF EMPT	WS: RIGHT FULL, LEFT Y.	370-GALT
LWD (DEGREES) TEL.			FOLLO HALF EMPT	WS: RIGHT FULL, LEFT Y.	370-GALT
CO CO CO CO CO CO CO CO CO CO CO CO CO C			FOLLO HALF EMPT	WS: RIGHT FULL, LEFT Y.	370-GALT
Pb/2V LWD (DEGREES)			FOLLO HALF EMPT	WS: RIGHT FULL, LEFT Y.	370-GALT
DANS) LWD (DEGREES) CO O O O O		<b>A</b> ⊙≪ <b>T</b>	FOLLO HALF EMPT	WS: RIGHT FULL, LEFT Y.	370-GALT
ANK - Pb/2V (AADIANS) TEL TEL TO G G G G G G G G G G G G G G G G G G G		<b>A</b> ⊙@ <b>*</b>	FOLLO HALF EMPT	WS: RIGHT FULL, LEFT 1.	370-GALT
DANS) LWD (DEGREES) CO O O O O		<b>A</b> ⊙≪ <b>T</b>	FOLLO HALF EMPT	WS: RIGHT FULL, LEFT 1.	370-GALT

#### FLIGHT TEST EVALUATION OF THE HODEL F-WE WITH THE POSITION MANEUVERING SLATS

FLT 287-260

MUN 22 DATE 11 MAT 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

MOLLING PERFORMANCE X - L/H SIDE SQUARE - R/H SIDE CONFIGURATION BASEC MODEL F-VE WITH THE POSITION HIND LUMBING LONGITUDINAL CONTROL SYSTEM THEALANCE HEIGHT. LONG FLIGHT TEST NOSEBOON, ENDS POD AT LEH FORMAND HISSILE WELL. SPARRON AT RIN FORMARD HISSILE HELL ENTRY CONDITIONS I CROSS 600 500 400 N/B ALTITUDE HPC FT Y 1000 200 100 0 1.4 1.2 MACH NO M N-B 40 0.6 FREE AIA TEMP O F.A.T. DEG C 0.4 20 40 150 100 50 NOT AVAILABLE 1.0 2.0 3.0 5.0 6.0 7.0 0.0

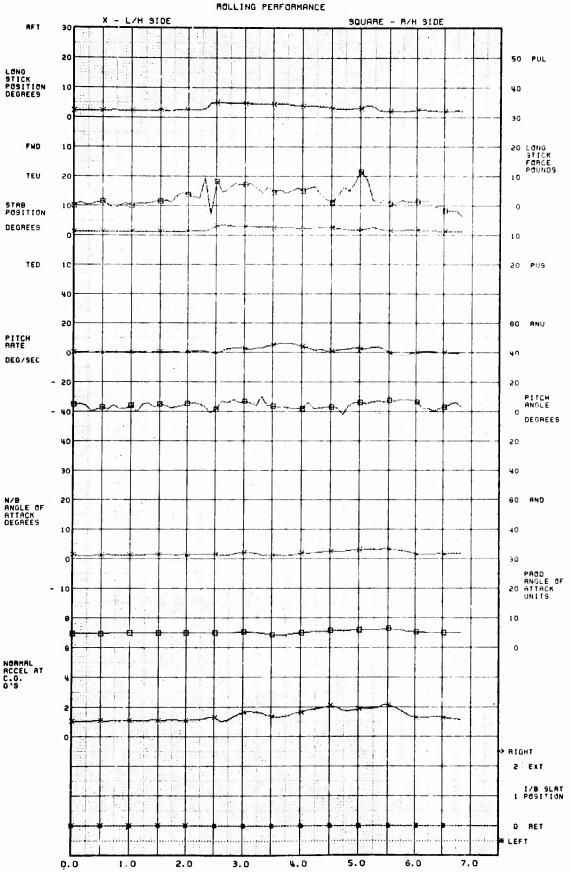
18, 18, 52, 859

ELAPSED TIME IN SECONDS

## FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS

F-UE MCRIR NO. 2280 DATE 11 MAY 1972

BY 1972



 $\begin{array}{c} \text{ELAPSED TIME IN SECONDS} \\ \text{Figure 149} \quad \text{Alleron Roll Time History ( Continued )} \end{array}$ 

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-260 RUN 22 DATE 11 MAY 1972 F-4E MCRIA NO. 2280 USAF 3/N 66-0287 ROLLING PERFORMANCE

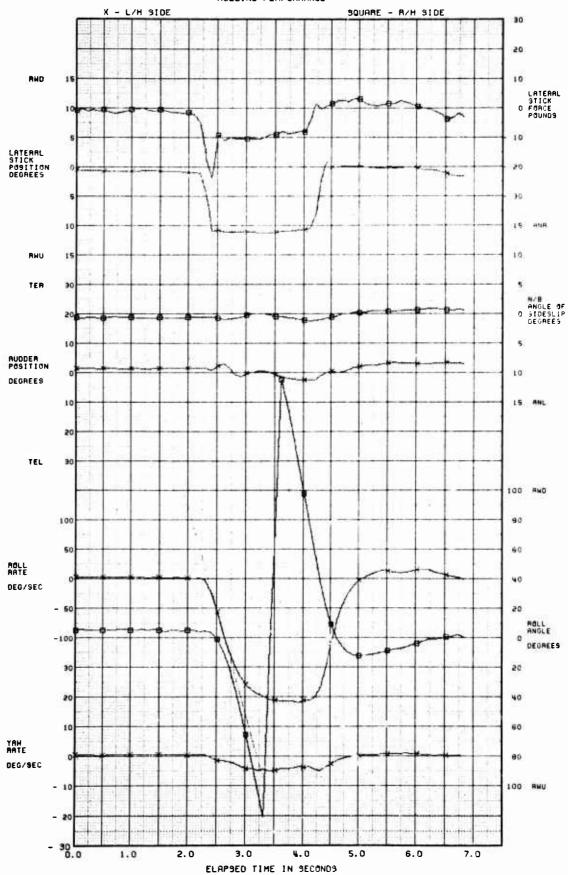


FIGURE 149 AILERON ROLL TIME HISTORY ( CONTINUED )

111

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-260

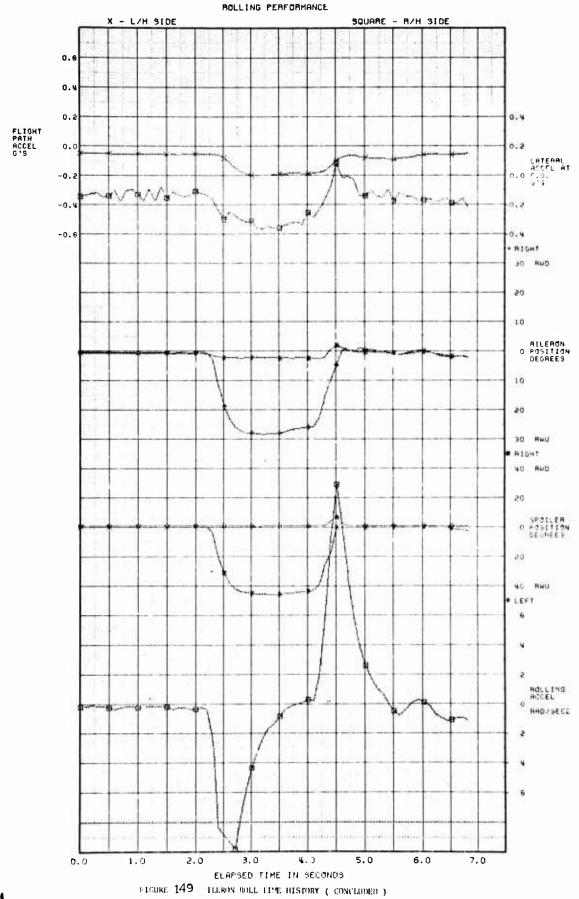
MUN 22

DATE 11 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287



## FLIGHT TEST EVALUATION OF THE MODEL F-4E HITH TWO POSITION MANEUVERING SLATS

FLT 287-269

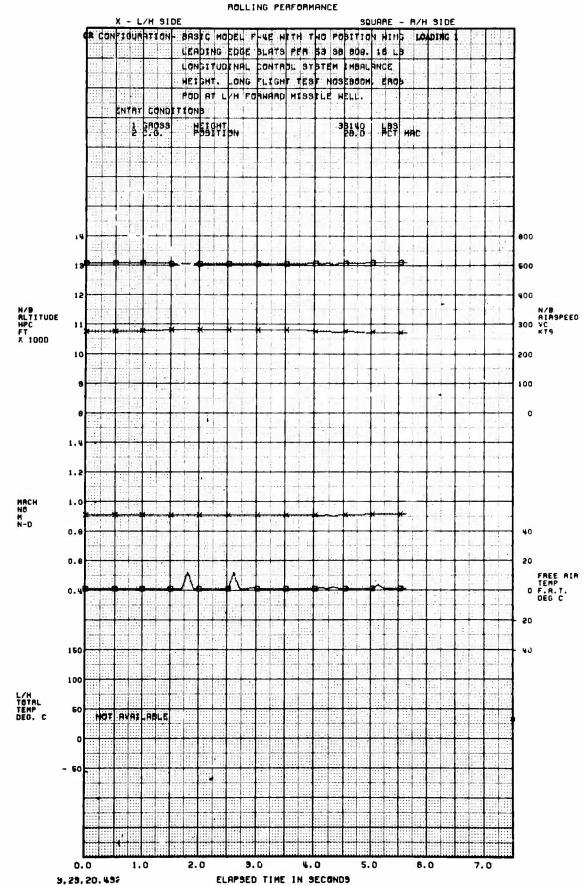
RUN 27

DATE 22 MAY 1972

F-4E

MCRIR NO. 2280

USAF 3/N 66-0287



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#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

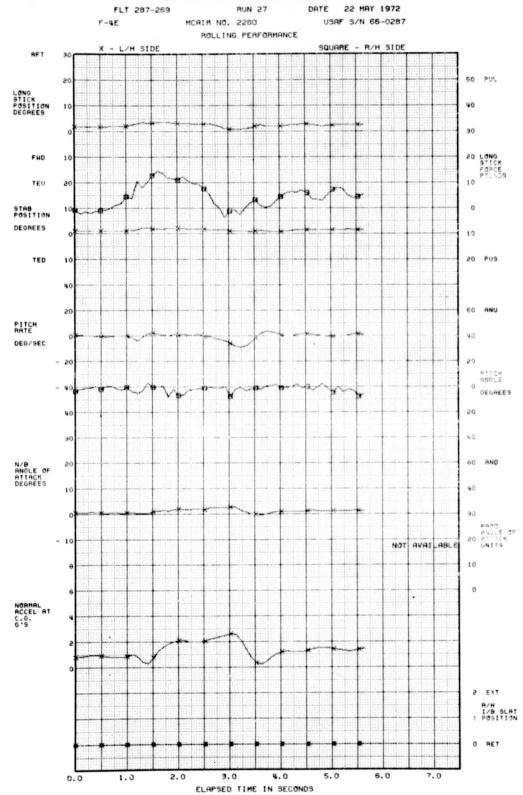


FIGURE 150 AILERON ROLL TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH THE POSITION MANEUVERING SLATS

FLT 287-269

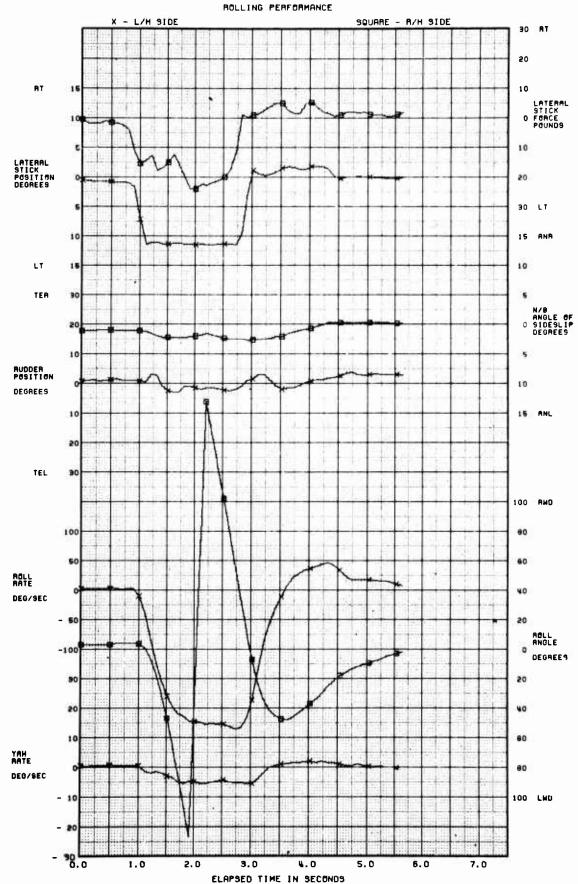
**BUN 27** 

DATE 22 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287



#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-269

RUN 27

DATE 22 MAY 1972

F-4E

FLIGHT PATH ACCEL G'S

MCAIR NO. 2280

USAF 3/N 66-0287



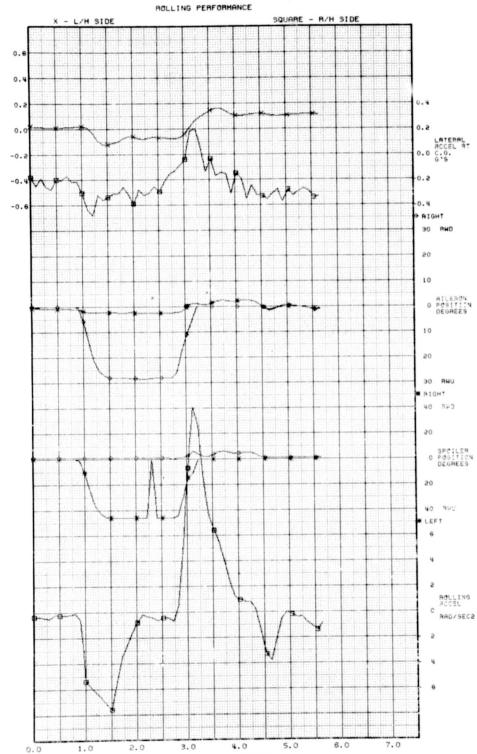


FIGURE 150 ALLERON ROLL TIME HISTORY ( CONCLUDED )

ELAPSED TIME IN SECONDS

0.0

# FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO : DSITION MANEUVERING SLATS

FLT 287-260 F-4E

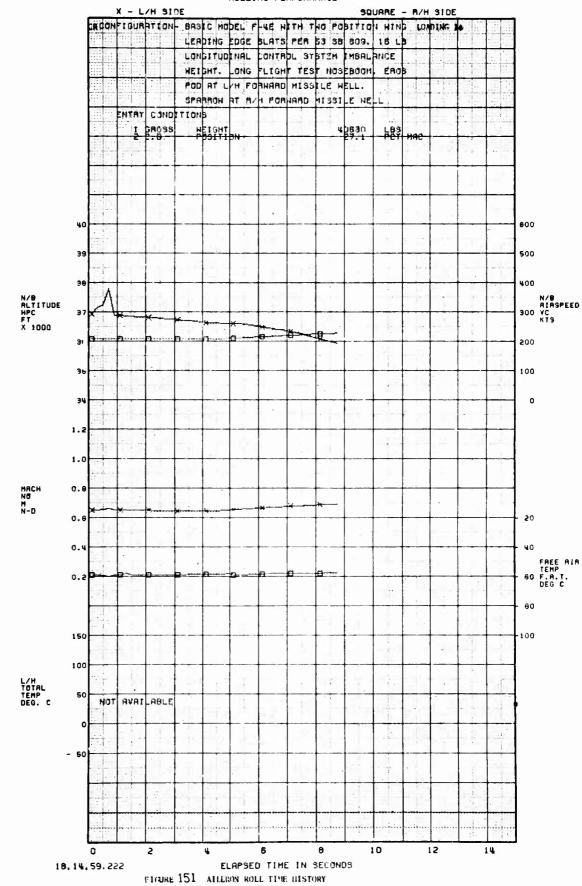
RUN 09

DATE 11 MAY 1972

E MCAIR No. 2280

USAF 3/N 66-0287

MOLLING PERFORMANCE



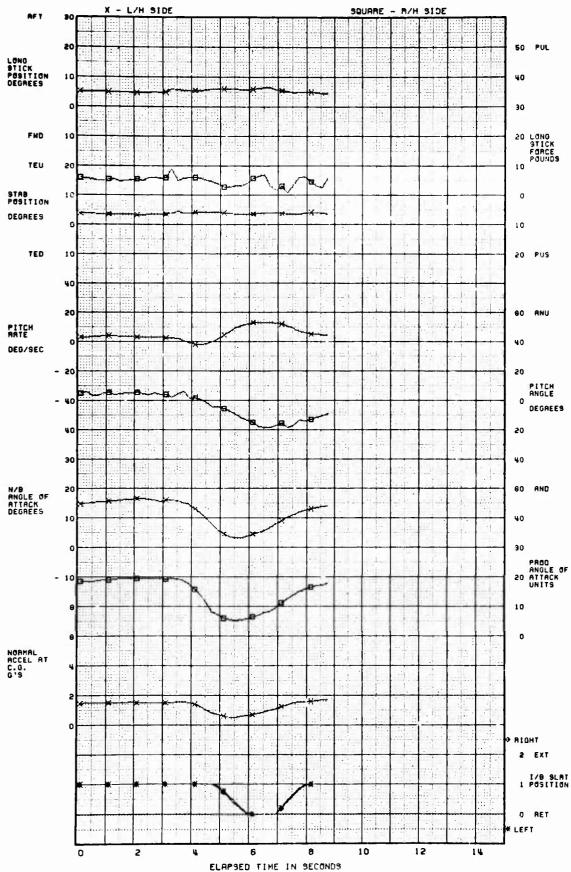
## FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS

FLT 287-260

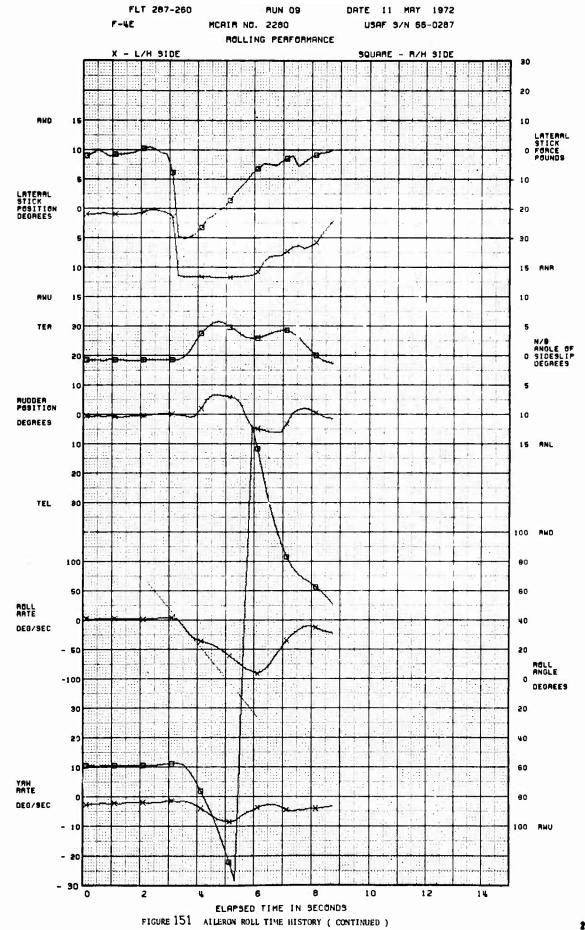
F-4E

RUN 09 MCRIR NO. 2280 DRTE 11 MAY 1972 USAF S/N 86-0287

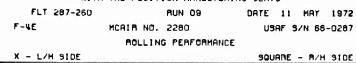
MOLLING PERFORMANCE



## FLIGHT TEST EVALUATION OF THE MODEL F-4E HITH THO POSITION MANEUVERING SLATS



FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS



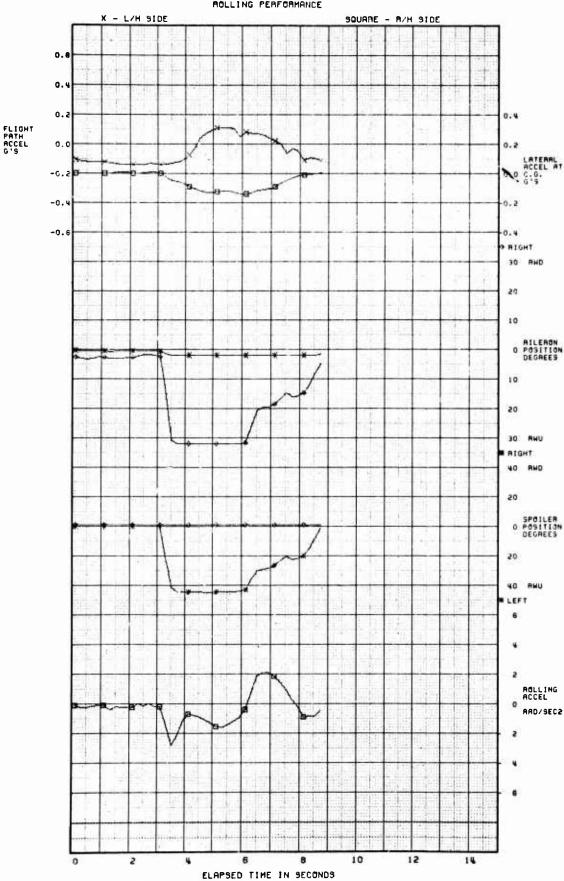


FIGURE 151 ALLERON ROLL TIME HISTORY ( CONCLUDED )

**RUN 23** 

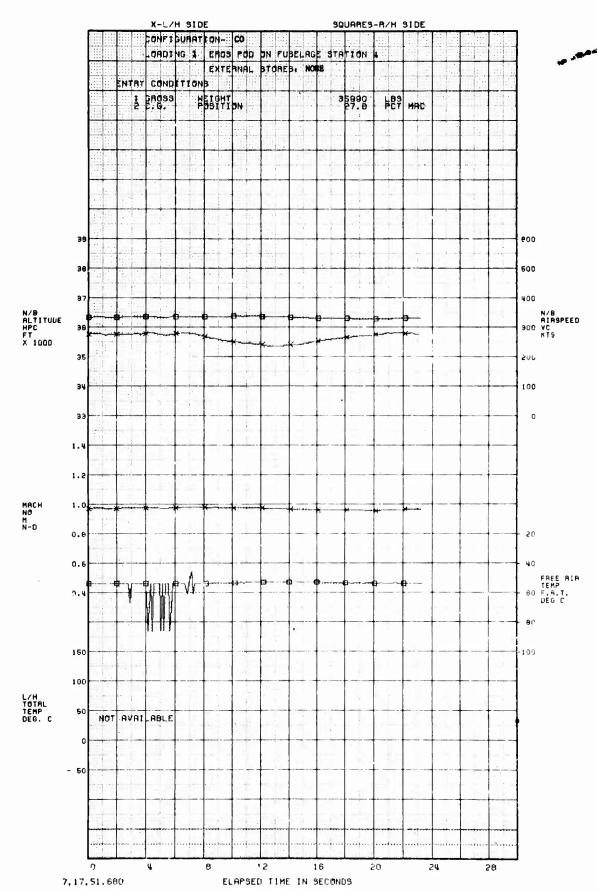


FIGURE 152 AILERON ROLL TIME HISTORY

RUN 23

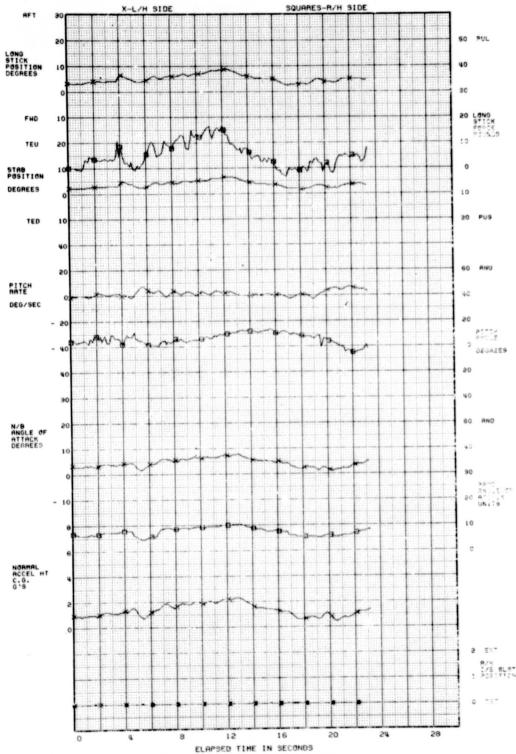


FIGURE 152 AILERON ROLL TIME HISTORY ( CONTINUED )

**RUN 23** 

DATE 24 MRY 1972

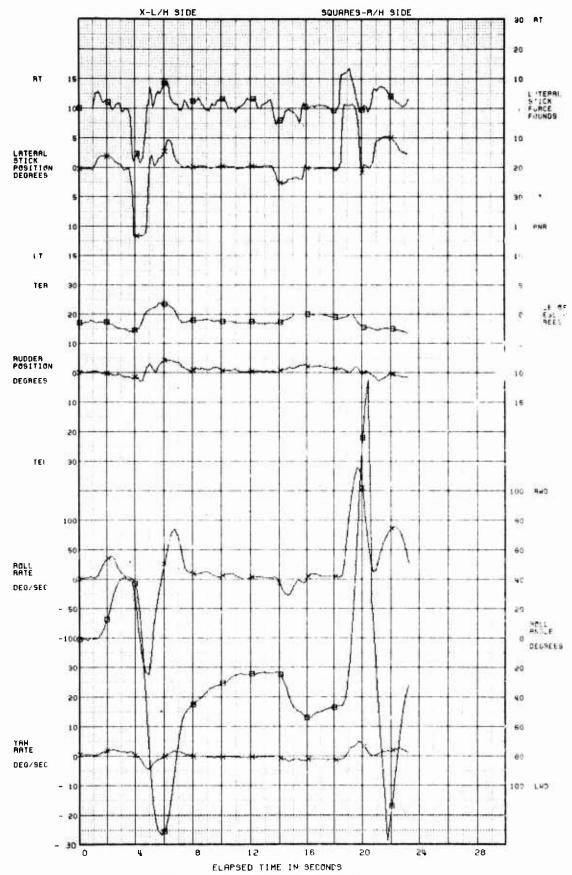


FIGURE 152 ATLERON ROLL TIME HISTORY ( CONTINUED )

11 1年二年五十二

RUN 23

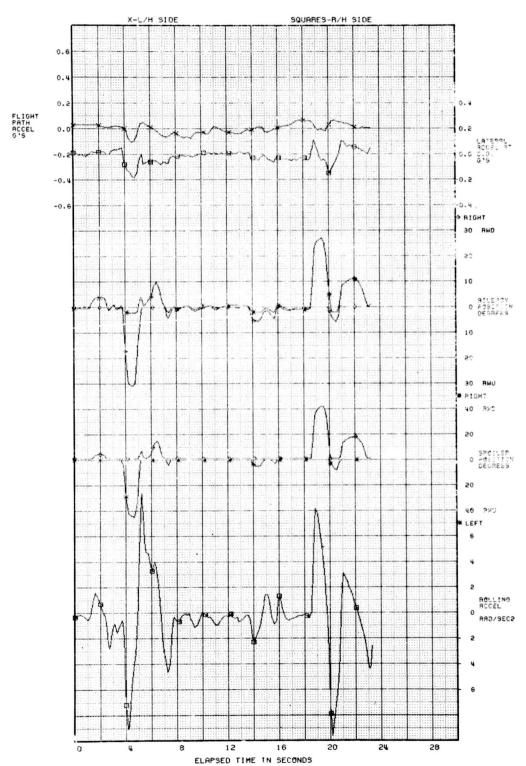
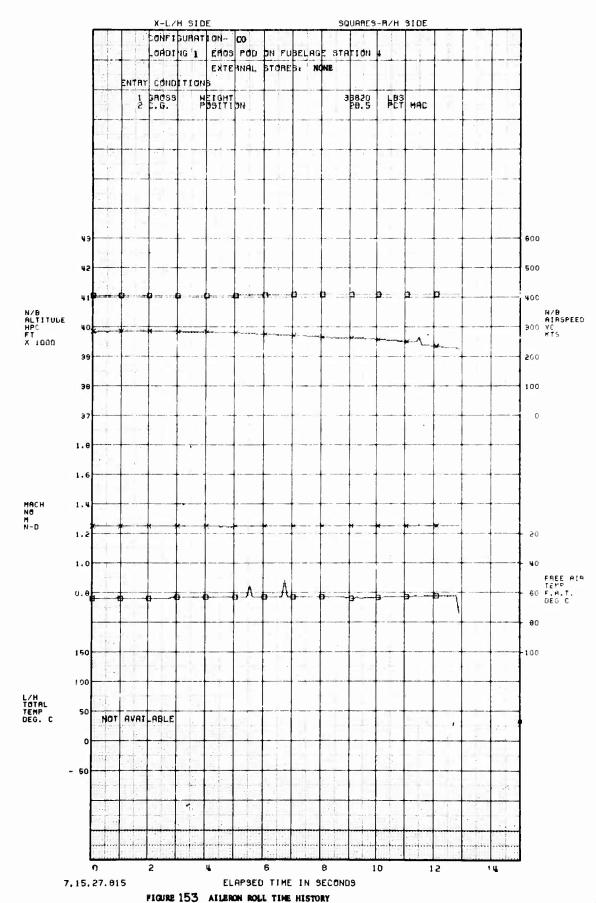


FIGURE 152 AILERON ROLL TIME HISTORY ( CONCLUDED )

**RUN 20** 

DATE 24 MAY 1972



こしまったい

FLT 207-273

**RUN 20** 

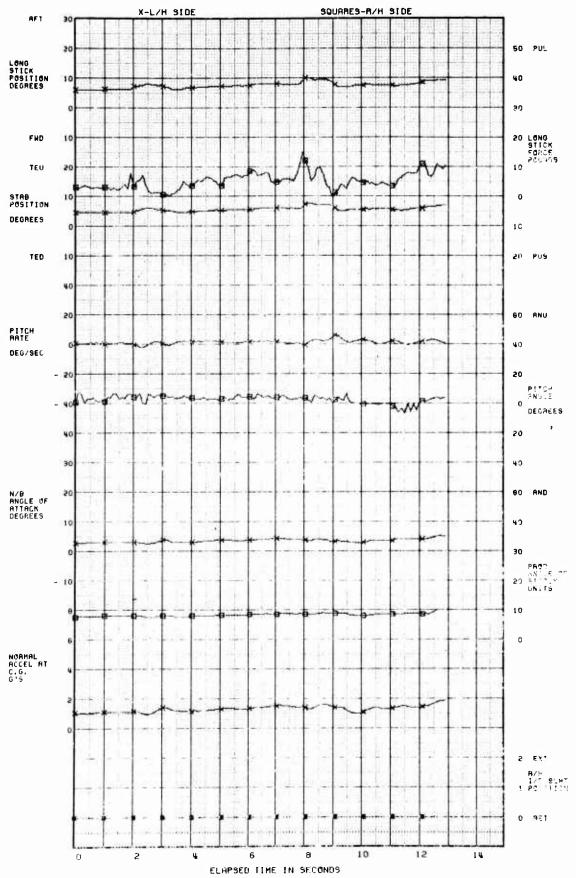


FIGURE 153 AILERON ROLL TIME HISTORY ( CONTINUED )

**RUN 20** 

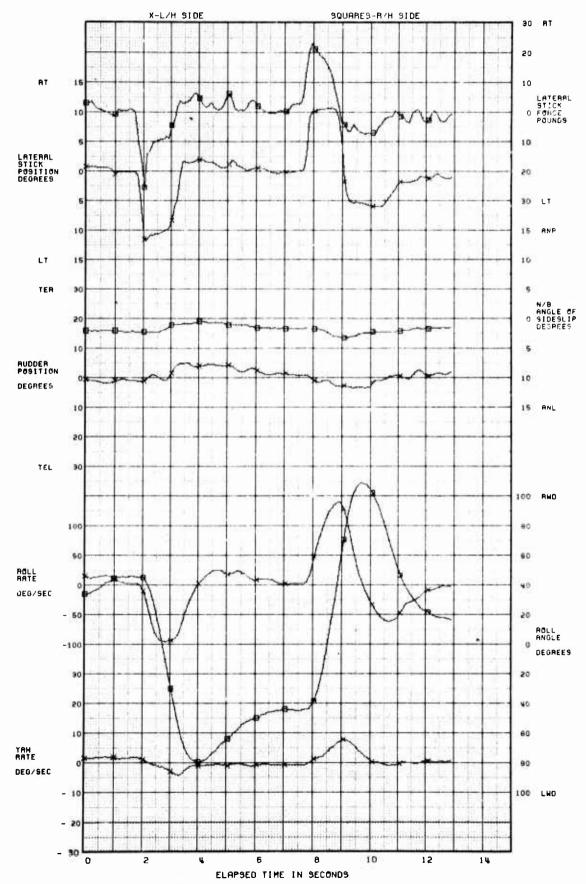


FIGURE 153 ALLERON ROLL TIME HISTORY ( CONTINUED )

**RUN 20** 



FIGURE 153 AILERON ROLL TIME HISTORY ( CONCLUDED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVEHING SLATS

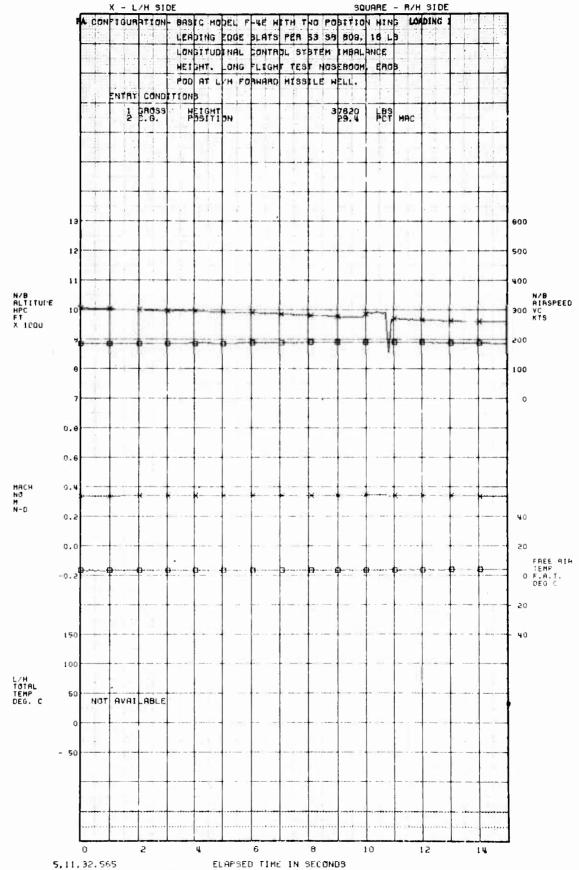
FL1 287-272

RUN 16 DATE 23 MAY 1972

MCAIA NO. 2280

USAF S/N 66-0287

ROLLING PERFORMANCE (GERR, SLATS, 30 DEG T.E. FLAPS)



## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-272

PUN 16

DATL 23 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

MOLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

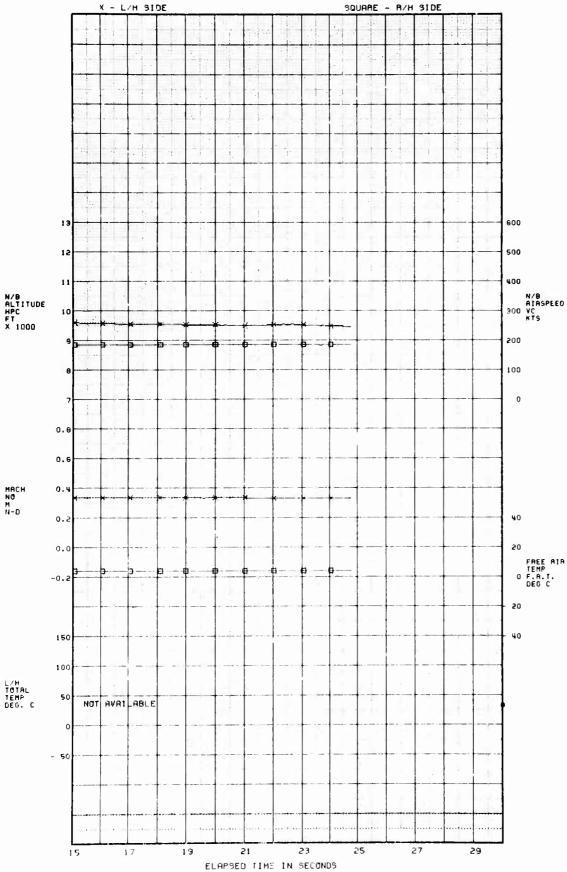
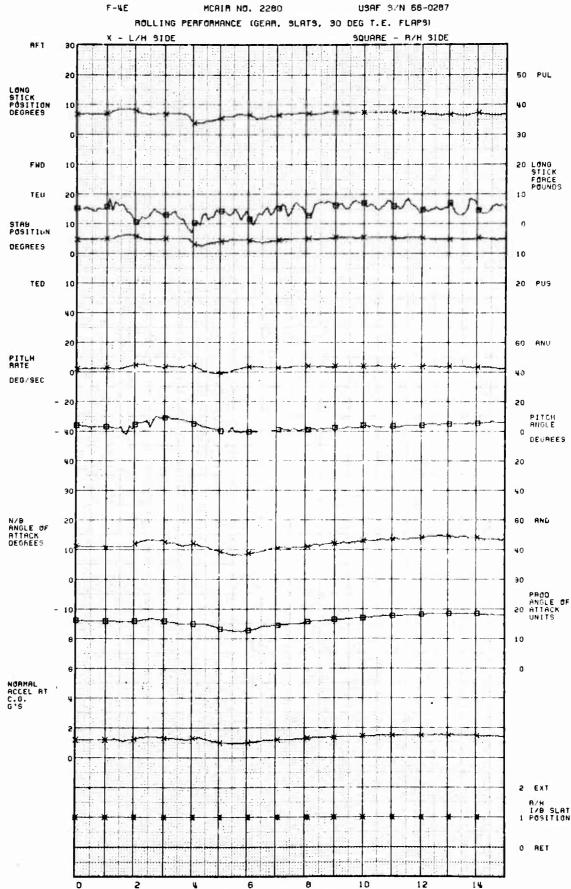


FIGURE 154 AILERON ROLL TIME HISTORY ( CONTINUED )

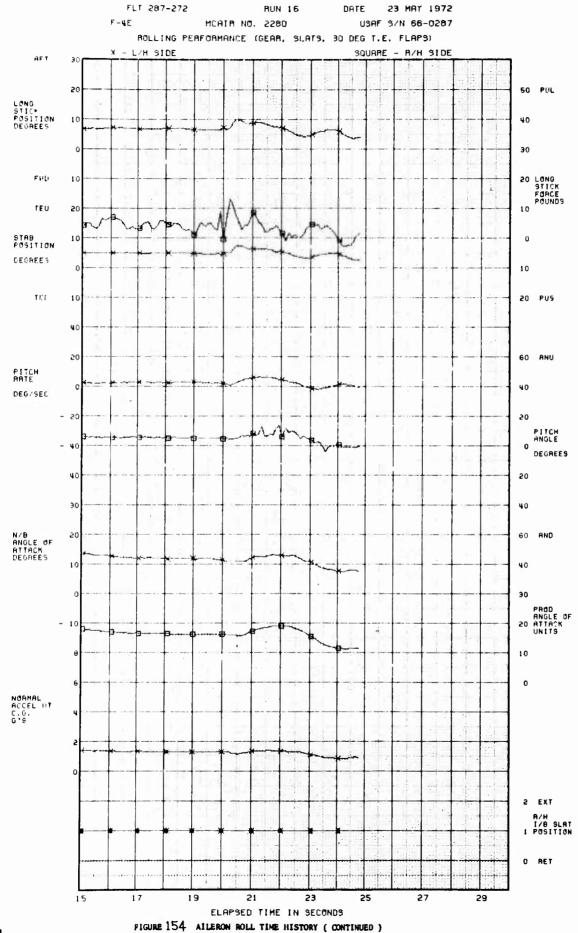
## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-272 RUN 16 DATE 23 MAY 1972 -4E MCAIR NO. 2280 USAF S/N 66-0287



ELAPSED TIME IN SECONDS

## FLIGHT TEST EVALUATION OF THE MODEL F-4E HITH THO POSITION MANEUVERING SLATS



## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-272 RUN 16 DATE 29 MAY 1972 F-4E MCRIA NO. 2280 USAF 5/N 66-0287 ROLLING PERFORMANCE (GEAR, SLA19, 30 DE 3 T.E. FLAPS)

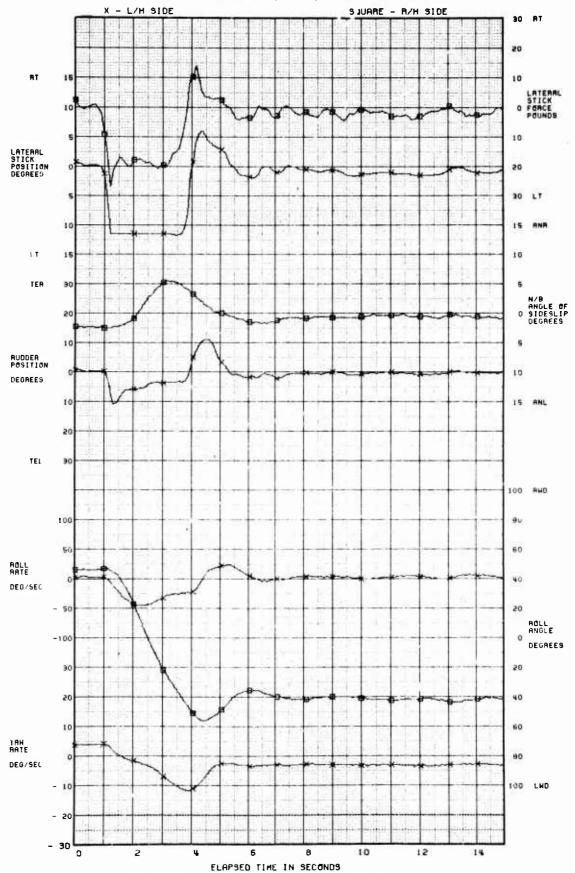


FIGURE 154 AILERON ROLL TIME HISTORY ( CONTINUED )

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-272 RUN 16 DATE 23 MAY 1972
F-4E MCAIR NO. 2280 USAF 3/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

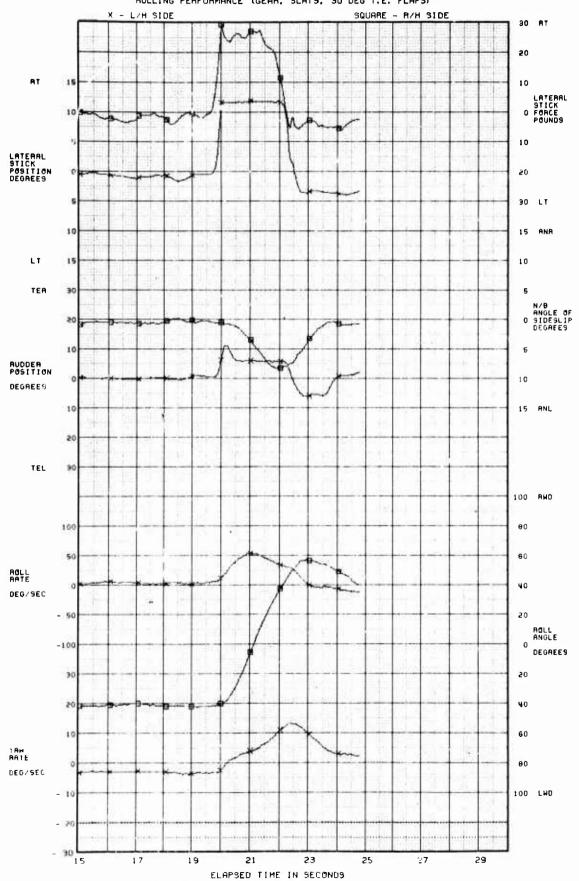
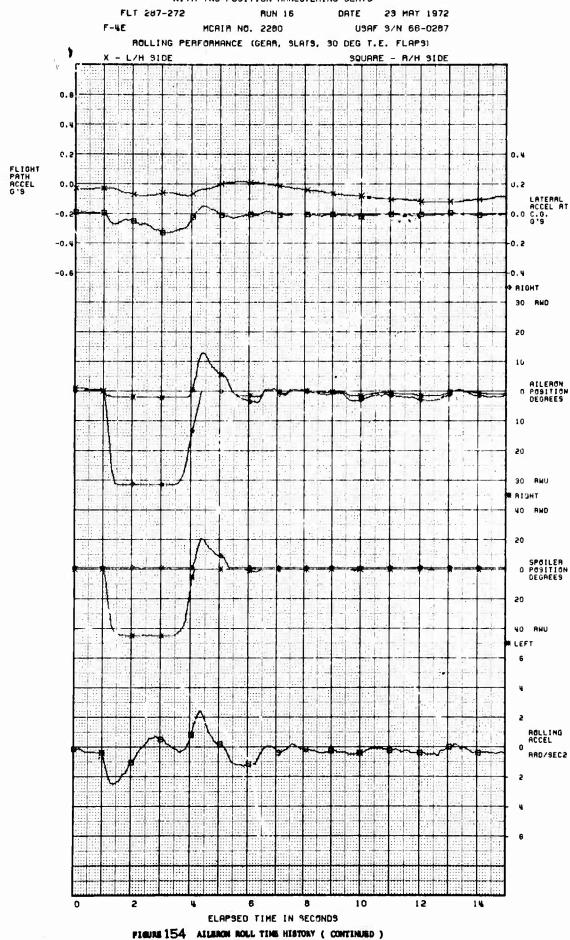


FIGURE 154 ALLERON ROLL TIME HISTORY ( CONTINUED )

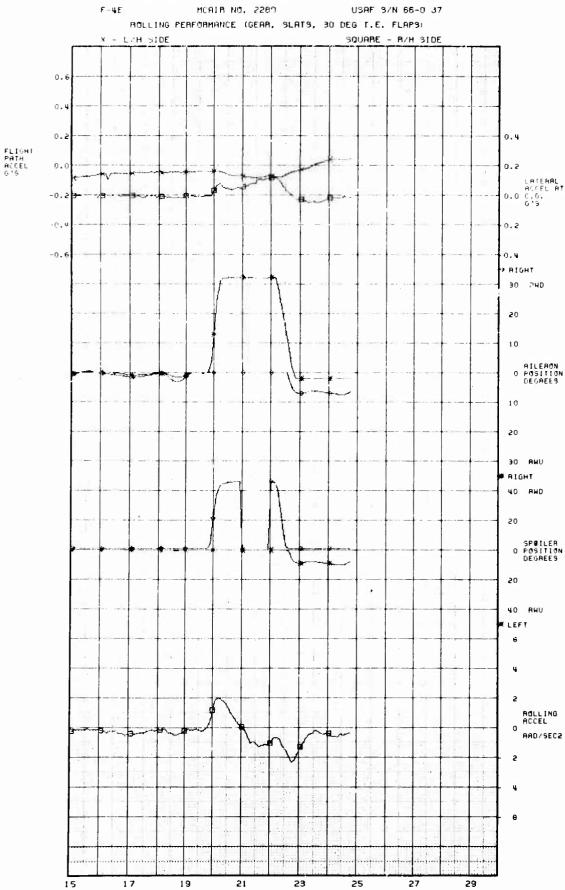
# FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS



#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-272

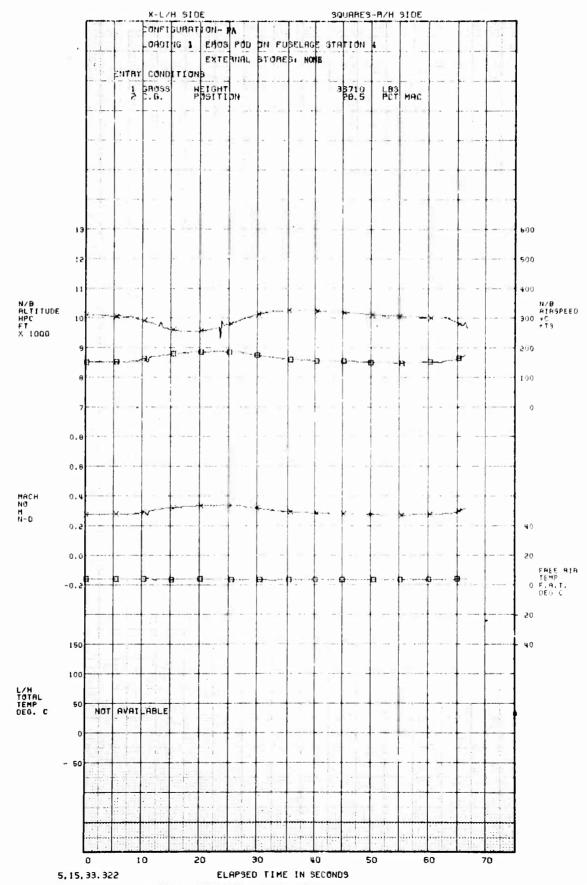
RUN 16



ELAPSED TIME IN SECONDS FIGURE 154 AILERON ROLL TIME HISTORY ( CONCLUDED )

**PUN 20** 

DATE 23 MAY 1972



The Royal

**RUN 20** 

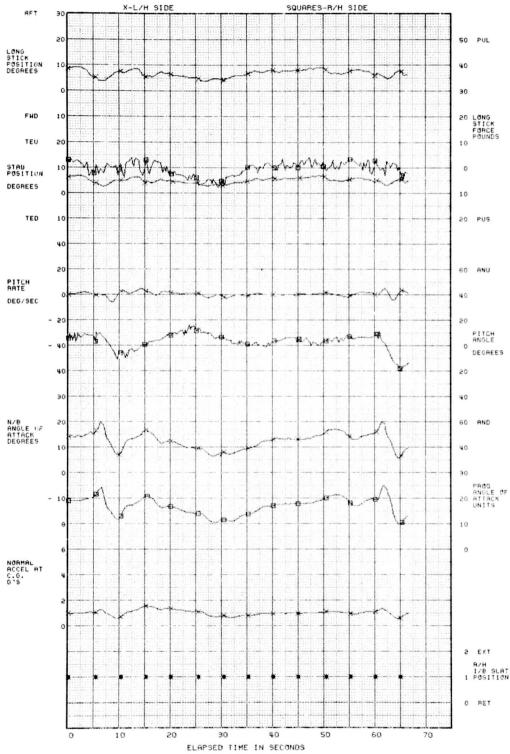


FIGURE 155 RUDDER ROLL TIME HISTORY ( CONTINUED )

**RUN 20** 

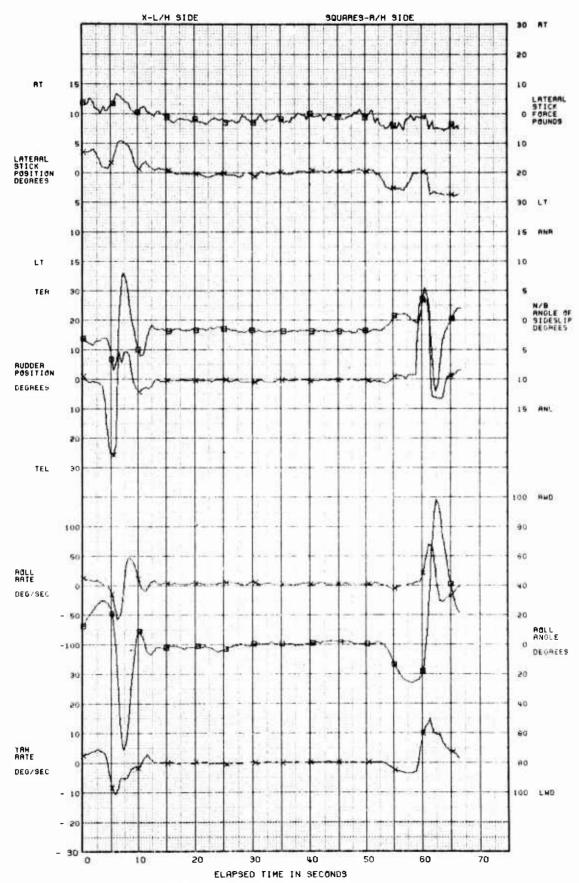


FIGURE 155 RUDDER ROLL TIME HISTORY ( CONTINUED )

FLT 287-272

RUN 20

DATE 23 MAY 1972

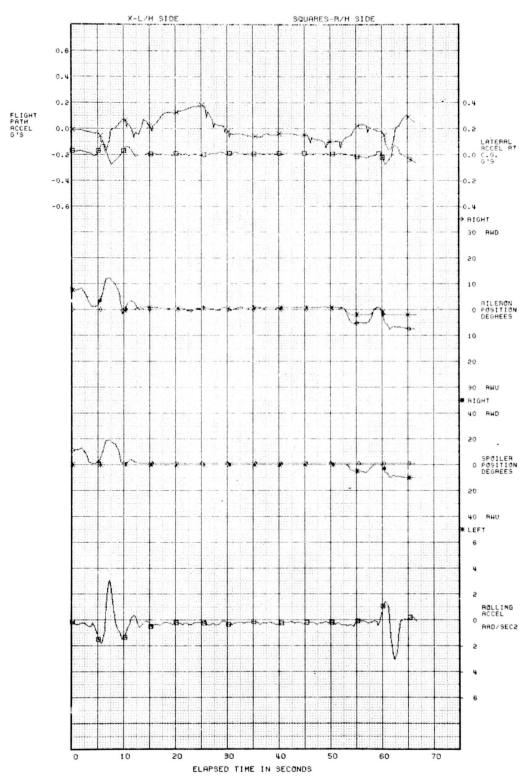


FIGURE 155 RUDDER ROLL TIME HISTORY ( CONCLUDED )

# FLIGHT TEST EVALUATION OF THE MODEL F-4E HITH THO POSITION MANEUVERING SLATS

FLT 287-272

**BUN 17** 

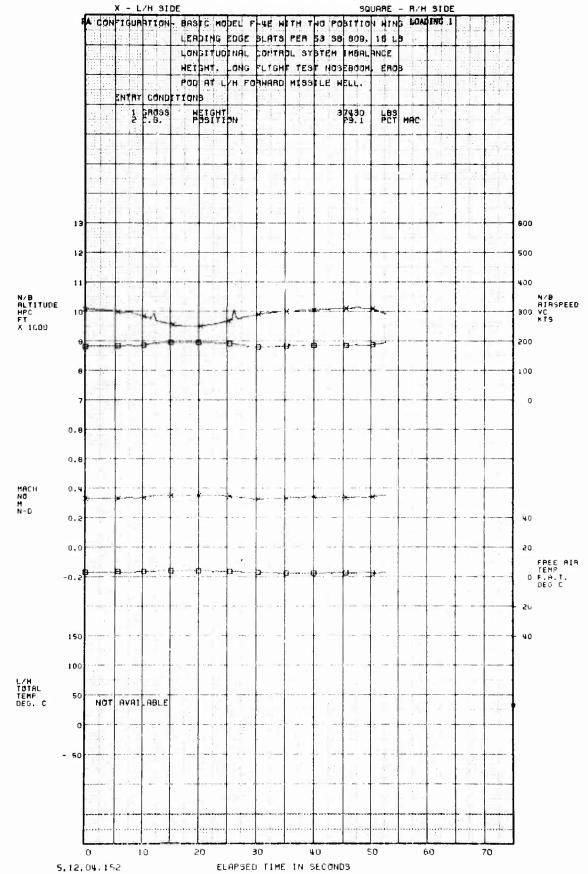
DATE 23 MAY 1972

F-4E

MCRIR NO. 2280

USAF S/N 66-0287

ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)



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## FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS FLT 287-272 RUN 17 DATE 23 MAY 1972 MCAIR NO. 2280 USAF 3/N 66-0287 MOLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS) SQUARE - R/H SIDE K - L/H SIDE 20 50 PUL LONG STICK POSITION DEGREES FND TEU STAB POSITION DEGREES 10 TEG 20 PU9 10 40 60 ANU PITCH RATE DEG/SEC PITCH O DEGREES 20 40 30 N/B ANGLE OF ATTACK DEGREES 60 AND 40 PAUG ANGLE OF 20 ATTHON UNITS 10 NORMAL ACCEL HT C.G. G'S

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ELAPSED TIME IN SECONDS

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# FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-272

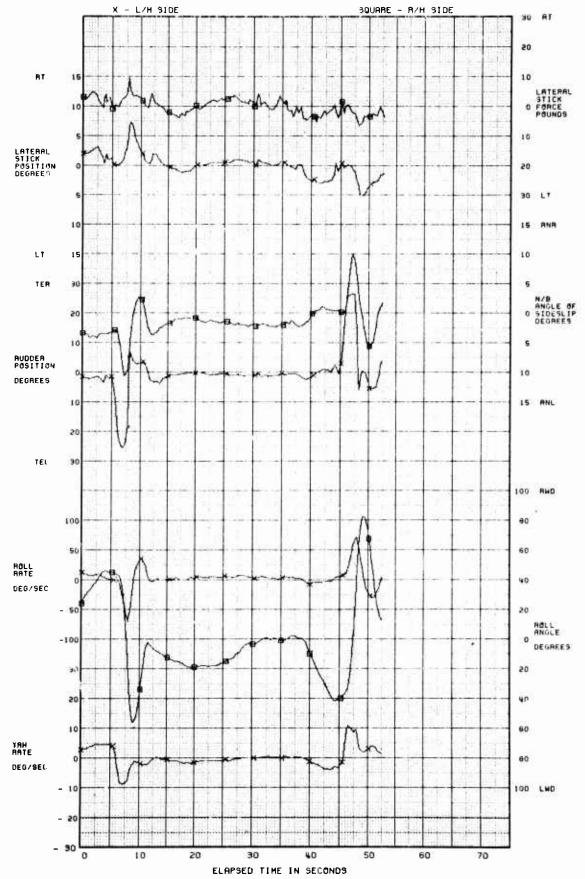
**R**UN 17

DATE 23 MAY 1972

F-4E MCRIR NO. 2280

USAF 3/N 66-0287

MOLLING PERFORMANCE (GERA, SLATS, 30 DEG T.E. FLAPS)



## FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH TWO POSITION MANEUVERING SLATS

FLT 287-272

**BUN 17** 

DATE 23 MAY 1972

F-UF

MCAIR NO. 2280

USAF S/N 66-0287

ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

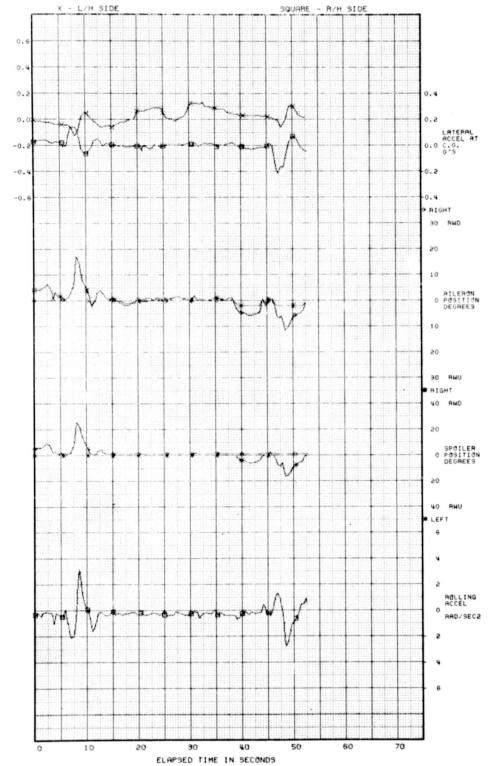
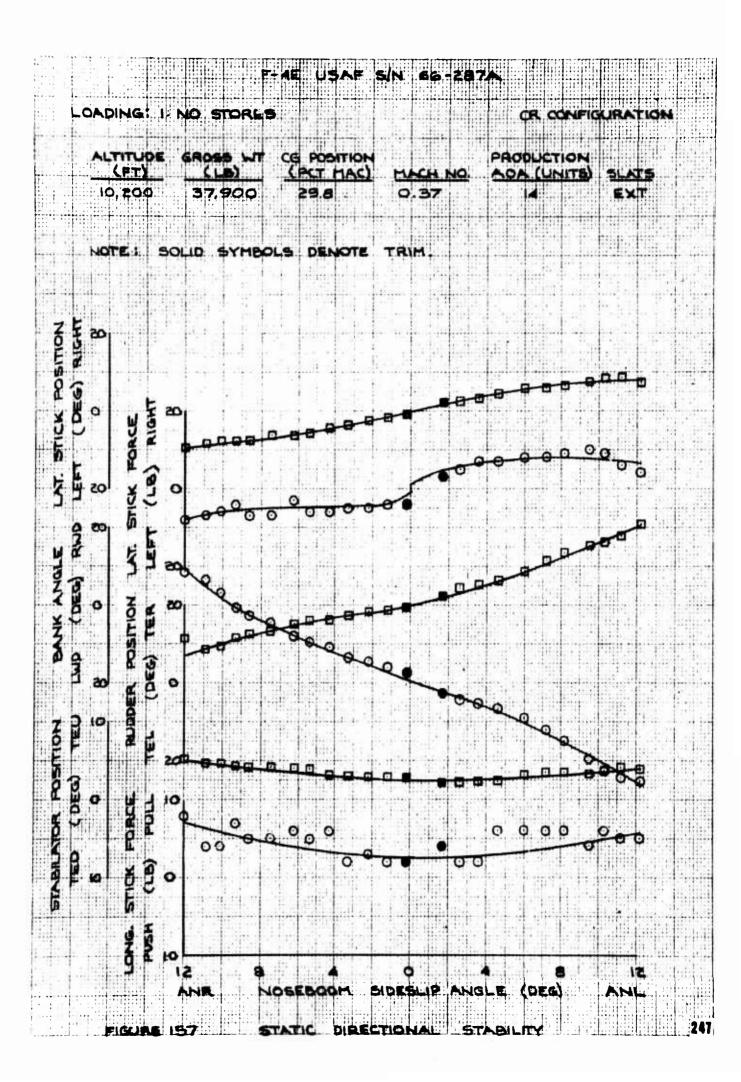


FIGURE 156 RUDDER ROLL TIME HISTORY ( CONCLUDED )

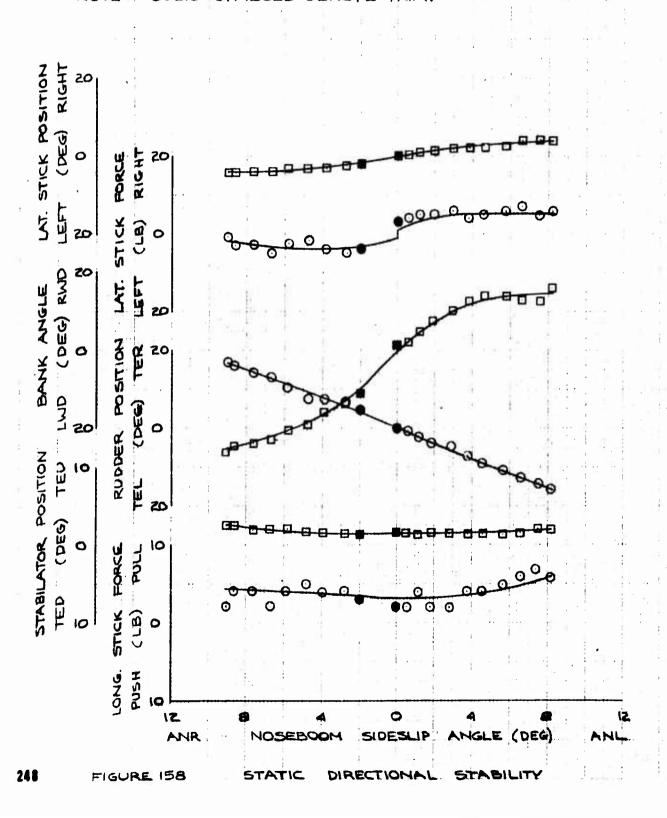


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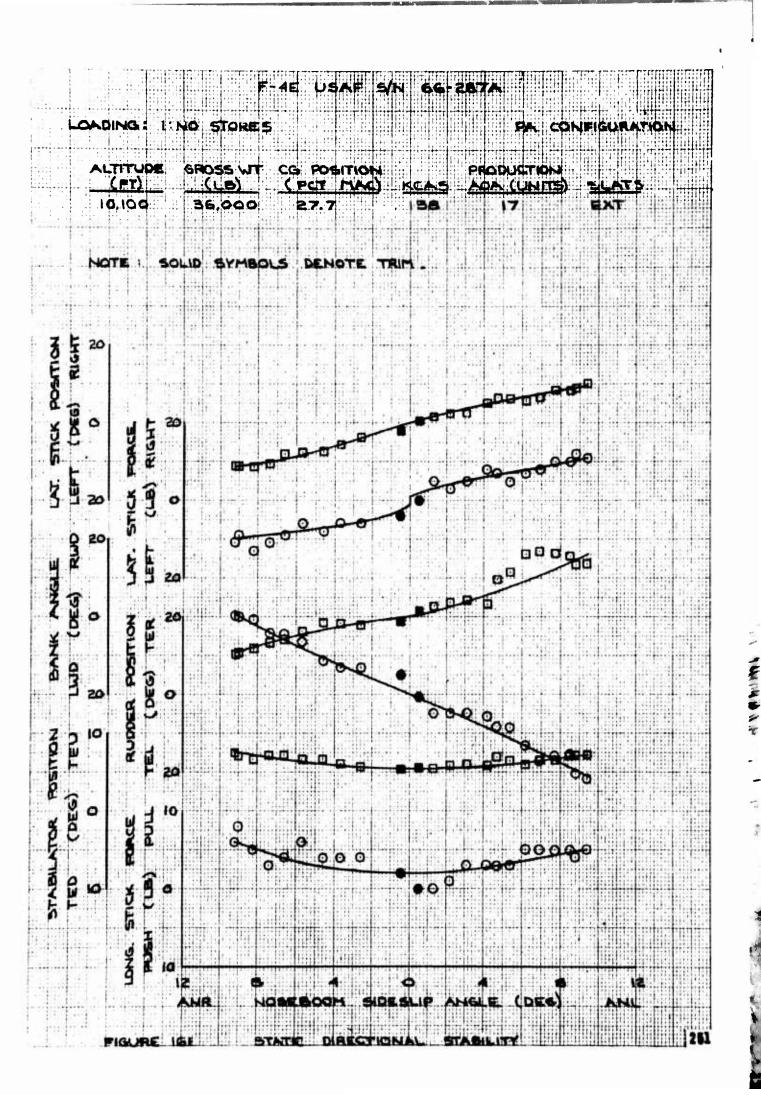
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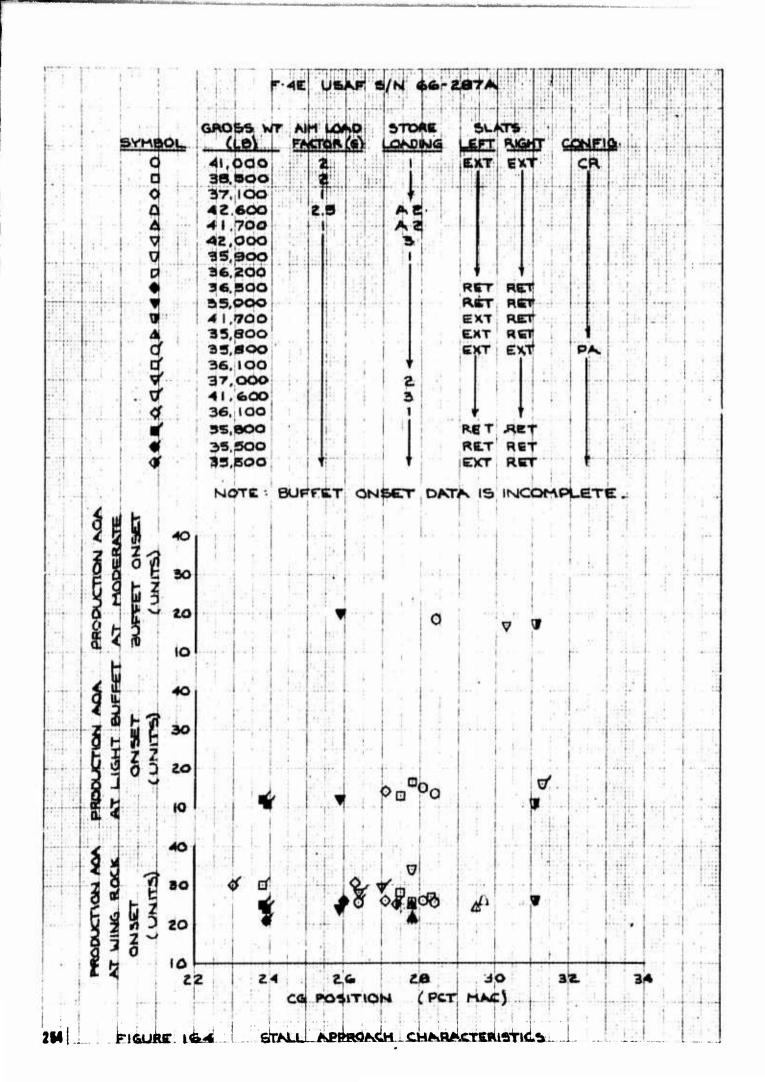
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#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE PESITION MANEUVERING SLATS

FLT 287-254

RUN 10 DATE 16 HAY 1972

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23, 25, 05, 207

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FIGURE 165 STALL APPROACH TIME HISTORY

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USAF 3/N 66-0287

F-4E MCAIR NO. 2280 APPROACH TO STALL SQUARE - R/H SIDE X - L/H SIDE CONFIGURATION BASEC MODEL F-4E HETH THO POSITION HING LOADING 1 LEADING EDGE BLATS PER 53 38 809. 16 LB LONGITUDINAL CONTROL STETEM IMBALANCE HEIGHT, LONG PLIGHT TEST NOSEBOOM, EACH POD AT LEH FORMARO MISSILE WELL. ENTRY CONDETIONS endss HEIGHT 누현구 HAC 600 500 400 200 100 21 0 20 0.6 0.6 MACH NG M N-D 0.4 0.2 0.0 150 100 L/H TOTAL TEMP DEG. C 50 NOT AVAILABLE

255

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### FLIGHT TEST EVALUATION OF THE MODEL F-45

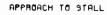
WITH THE POSITION MANEUVERING SLATS

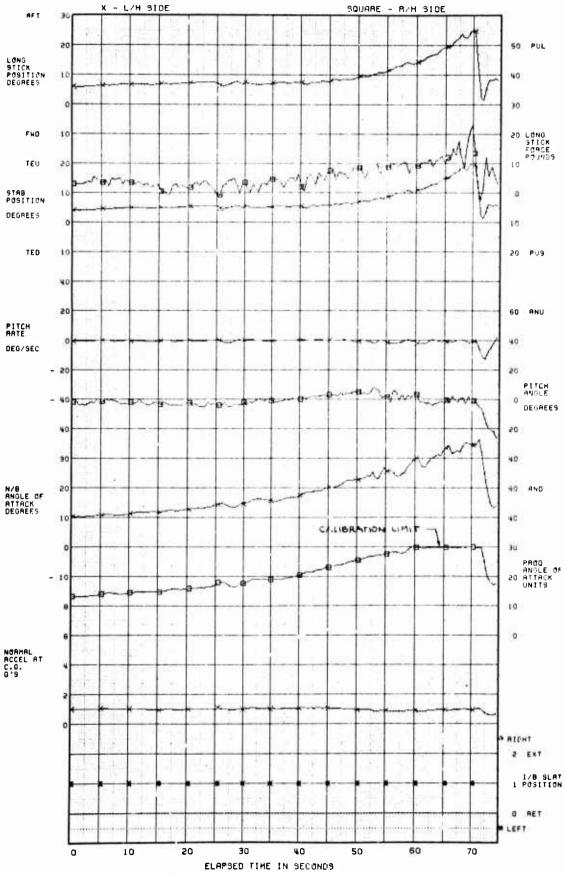
FLT 207-264 F-4E

**RUn 10** MCAIR NO. 2280

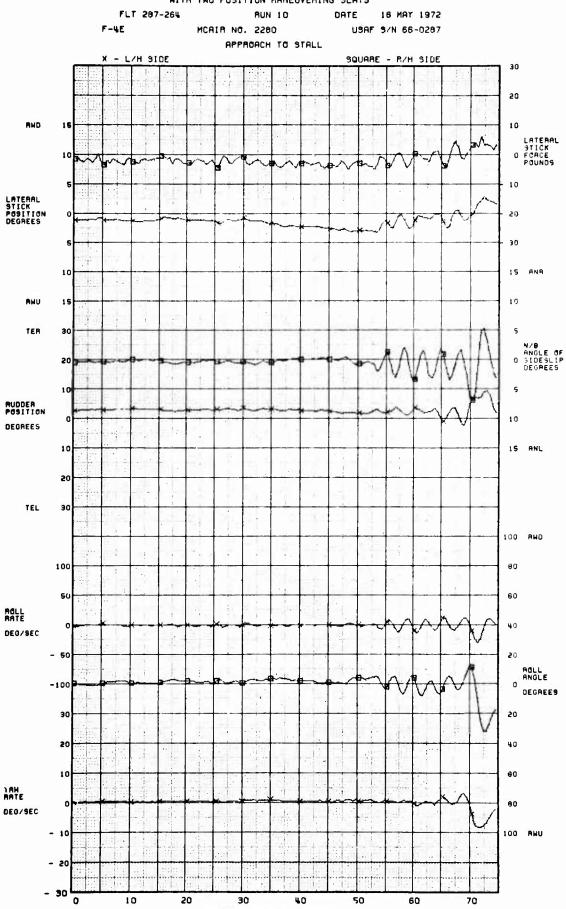
DATE 16 MAY 1972

USAF 3/N 66-0287





## FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH TWO POSITION MANEUVERING SLATS



ELAPSED TIME IN SECONDS

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

FLT 287-264

RUN 10

DATE 16 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

APPROACH TO STALL X - L/H SIDE SQUARE - R/H SIDE 0.4 0.2 0.4 FLIGHT PATH ACCEL G'9 0.0 LATERAL ACCEL AT 0.0 C.G. 0'9 -0.2 -0.4 0.2 -0.6 0.4 PRIGHT. 30 AHO 90 20 40 ANU LEFT ACCEL ACCEL AND/SECS :0 30

FIGURE 165 STALL APPROACH TIME HISTORY ( CONCLUDED )

ELAPSED TIME IN SECONDS

## FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS

FLT 287-243

RUN 06

DATE 25 APRIL 1972

F-4E

MCAIR NO. 2280

USAF 9/N 66-0287

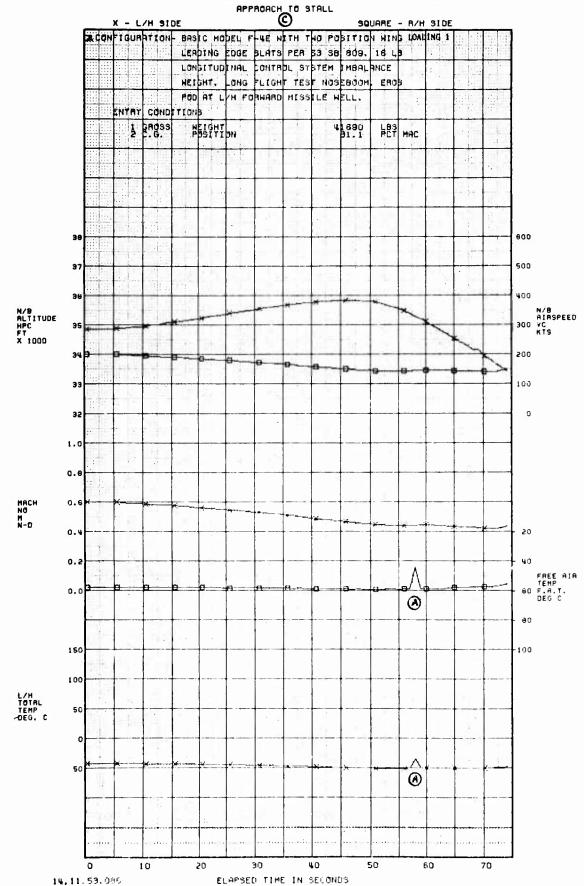
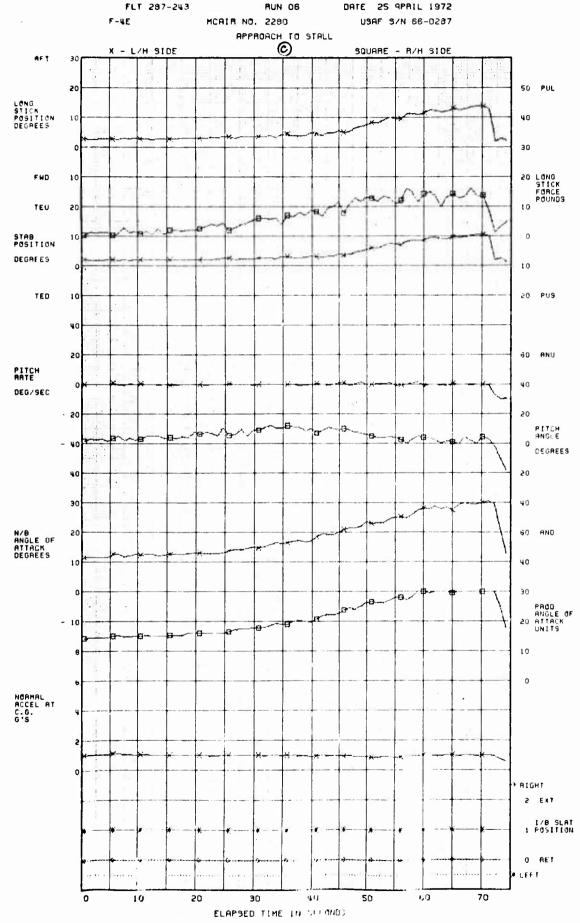
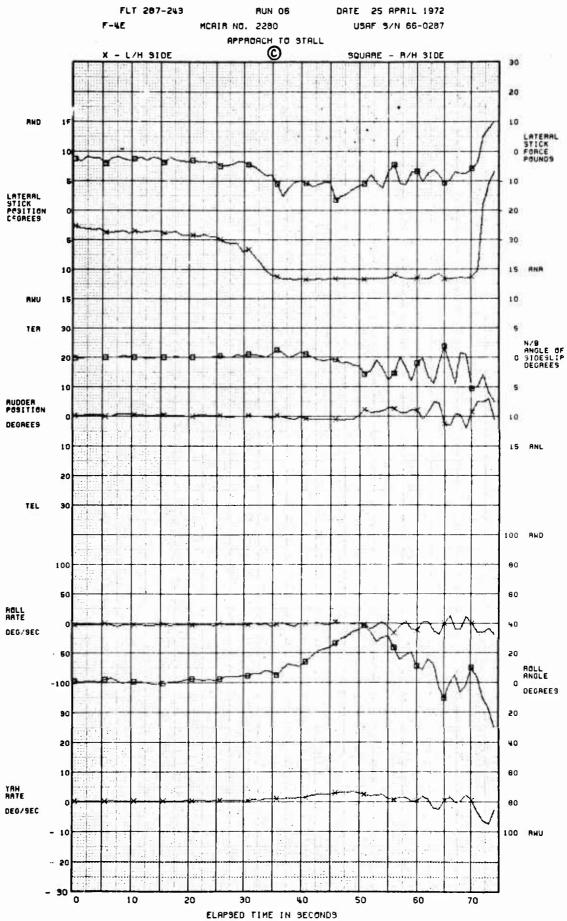


FIGURE 166 STALL APPROACH TIME HISTORY

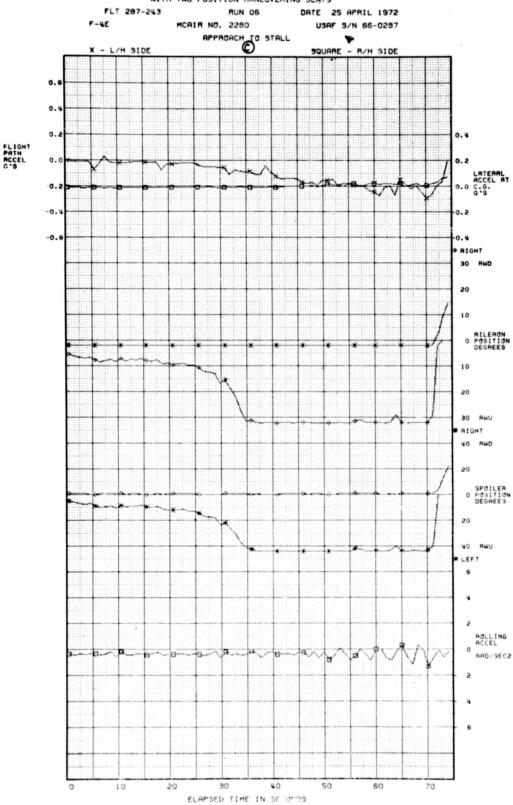
## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS



## FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS



## FLIGHT TEST EVALUATION OF THE MODEL F-WE NITH THO POSITION MANEUVERING SLATS



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#### FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH THO POSITION MANEUVERING SLATS

FLT 287-259

F-4E

MCRIR NO. 2280

MUN 13 DATE 11 MAY 1972 USRF 3/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE SQUARE - R/H SIDE A CONFIGURATION - BASEC MODEL FINE WITH THE POSITION HIND LOADING La LEADING EDGE BLATS PER 53 38 809, 16 LB LONDITUDENAL CONTADE STATEM IMBALANCE HEIGHT LONG FLIGHT TEST NOSEBOOM ENOS POD AT L. H FORWARD MISSILE WELL. SPARON AT RAY FORMAND MISSILE NE ENTRY CONDITIONS 600 500 400 M/B RLTITUDE HPC FT X 1000 N/B AIRSPEED 300 VC KTS 200 100 0 0.6 0.0 0.4 0.2 40 0.0 100 AVAI ABLE 20 0 10 30 40 60

16, 16, 49, 317

ELAPSED TIME IN SECONDS FIGURE 167 STALL APPROACH TIME HISTORY

### FLIGHT TEST EVALUATION OF THE MODEL F-4E MITH TWO POSITION MANEUVERING SLATS

FLT 287-259 RUN 13 DATE 11 MAY 1972 F-4E MCAIR NO. 2280 USAF S/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS) 50 PUL 20 LONG STICK POSITION DEGREES un. 30 20 LONG STICK FORCE POUNDS FND 10 TEU 10 STAB POSITION 0 DEGREES 10 20 PUS TED 60 ANU 20 PITCH RATE DEG/SEC DEGREES 20 40 90 N/B ANGLE OF ATTACK DEGREES PAGD ANGLE OF 20 ATTACK UNITS 10 10 40

FIGURE 167 STALL APPROACH TIME HISTORY ( CONTINUED )

ELAPSED TIME IN SECONDS

### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

WITH THO POSITION MANEUVERING SLATS FLT 287-259 **MUN 13** DATE 11 MAY 1972 MCRIR NO. 2280 USRF 3/N 66-0287 APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS) X - L/H SIDE RND LATERAL STICK POSITION DEGREES 30 15 ANA MHU TER RUDDER POSITION 10 DEGREES 15 ANL TEL LOO RHD 100 80 60 ROLL 40 DEG/SEC 20 ABLL ANGLE -100 DEC 41 ES 20 40 60 YAH BRTE 60 DEG/SEC 100 ANU

FIGURE 167 STALL APPROACH TIME HISTORY ( CONTINUED )

ELAPSED TIME IN SECONDS

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### FLIGHT TEST EVALUATION OF THE MODEL F-WE WITH THE POSITION MANEUVERING SLATS

FLT 287-259

**RUN 13** 

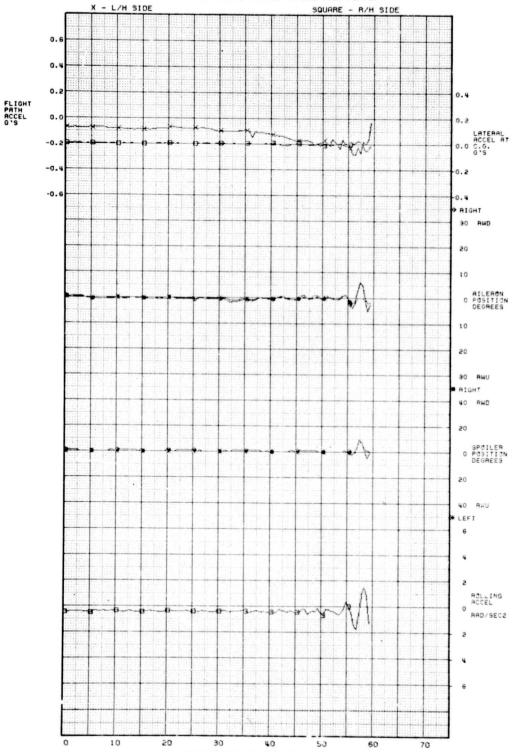
DATE 11 MAY 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)



ELAPSED TIME IN SECONDS FIGURE 167 STALL APPROACH TIME HISTORY ( CONCLUDED )

## FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-259

MUN 15

DATE 11 MAY 1972

F-4E

MCRIR NO. 2280

USAF 3/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG 1.E. FLAPS)

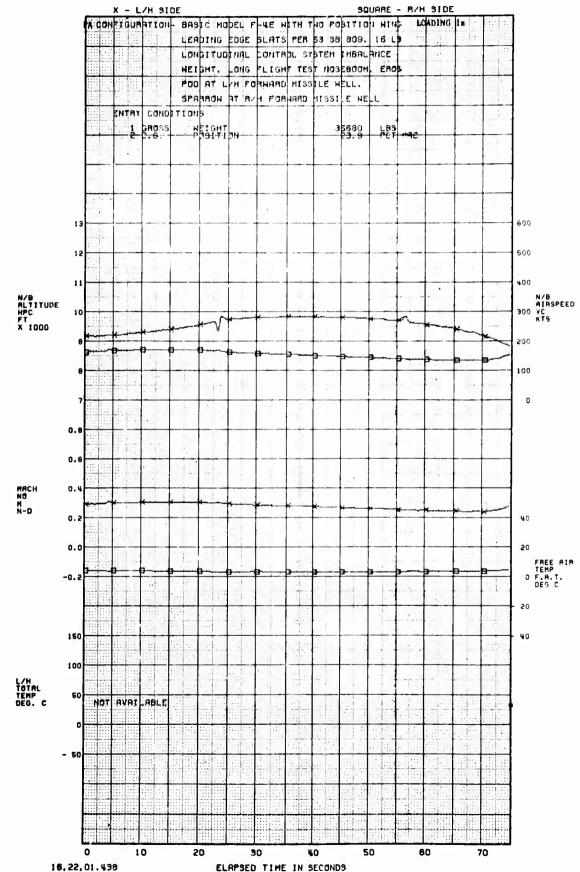


FIGURE 168 STALL APPROACH TIME HISTORY

THE MENT

# FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THO POSITION MANEUVERING SLATS

FLT 287-259 AUN 15 DATE 11 MAY 1972

F-WE MCAIR NO. 2280 U3AF 3/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

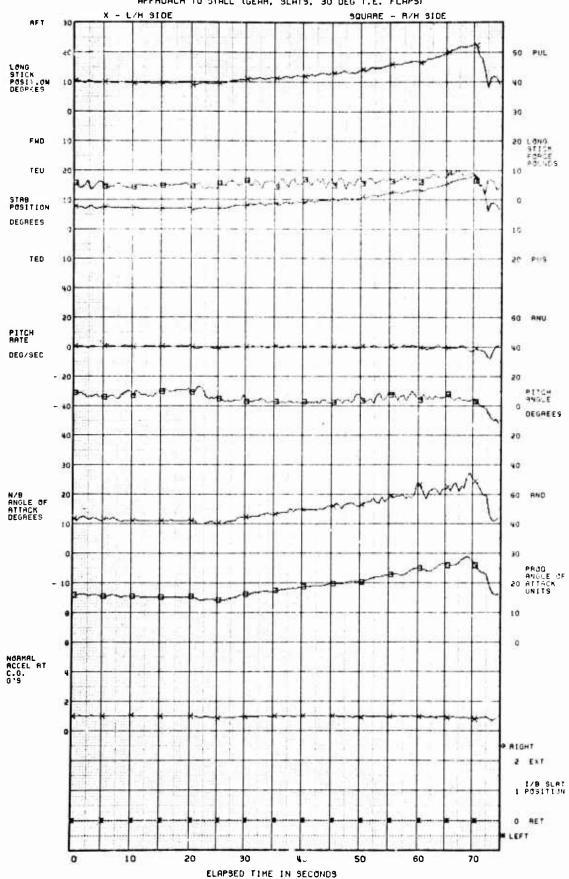


FIGURE 168 STALL APPROACH TIME HISTORY ( CONTINUED )

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

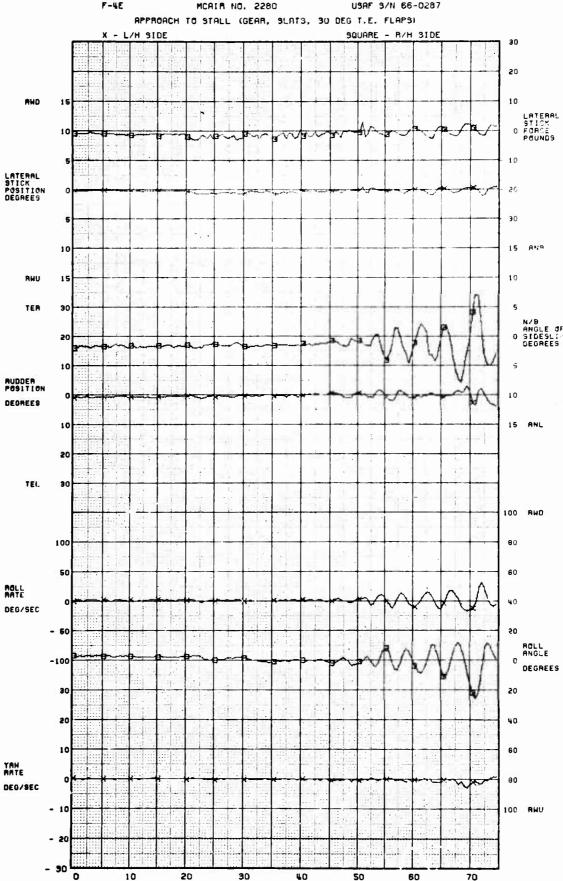
FLT 287-259

RUN 15

DATE 11 MAY 1972

F-4E

USAF 3/N 66-0287



ELAPSED TIME IN SECONDS FIGURE 168 STALL APPROACH TIME HISTORY ( CONTINUED ) The Mark of

#### FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH THE POSITION MANEUVERING SLATS

FLT 287-259

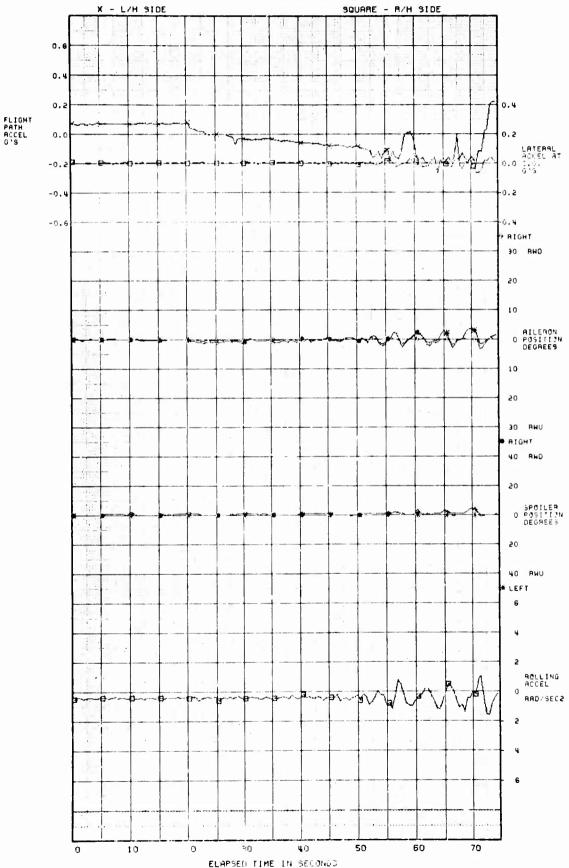
RUN 15 DATE 11 MAY 1972

F-4E

MCRIR NO. 2280

USRF 3/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)



# FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-240

**RUN 19** 

DATE 24 APRIL 1972

F-4E

MCAIR NO. 2280

USAF 3/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS) 0 SQUARE - R/H 31DE X - L/H SIDE PACONFIGURATION - BASIC NODEL F-4E NETH THO POSITION HIND INVOING LEADING EDGE BLATS PER 53 SB 809. 16 LB CONDITUDINAL CONTACT STATEM IMBALANCE HEIGHT. LONG FLIGHT TEST NOSEBOON EROS POD AT L'H FORMAND MISSILE WELL. ENTRY CONDITIONS METCHT POSITION ROSS 35460 PCT HAC 600 500 12 400 N/B ALTITUDE HPC FT X 1000 200 100 0.6 MACI' NO N-D 0.4 0.0 -0.2 60 150 100 L/H TOTAL TEMP DEG. C 50 - 50 12 20 24

ELAPSED TIME IN SECONDS

10, 28, 23, 387

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### FLIGHT TEST EVALUATION OF THE MODEL F-4E

WITH THE POSITION MANEUVERING SLATS FLT 287-240 **RUN 19** DATE 24 APRIL 1972 F-4E MCRIR NO. 2280 USAF S/N 66-0287 APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

/H SIDE SQUARE - R/H X - L/H SIDE SQUARE - R/H SIDE AF T 30 50 PUL LONG STICK POSITION DEGREES 40 TEU STAB POSITION DEGREES TED 20 PU9 60 ANU PITCH DEG/9EC DEGREES 20 40 N/B ANGLE OF ATTACK DEGREE > 60 AND 40 30 PAGD ANGLE OF 20 ATTACK UNITS 10 NORMAL ACCEL HT C.G. G'S RIGHT 2 EXT 1/B SLFT 1 POSITION O RET 12 16

FIGURE 169 STALL APPROACH TIME HISTORY ( CONTINUED )

ELAPSED TIME IN SECONDS

# FLIGHT TEST EVALUATION OF THE MODEL F-4E NITH THO POSITION MANEUVERING SLATS

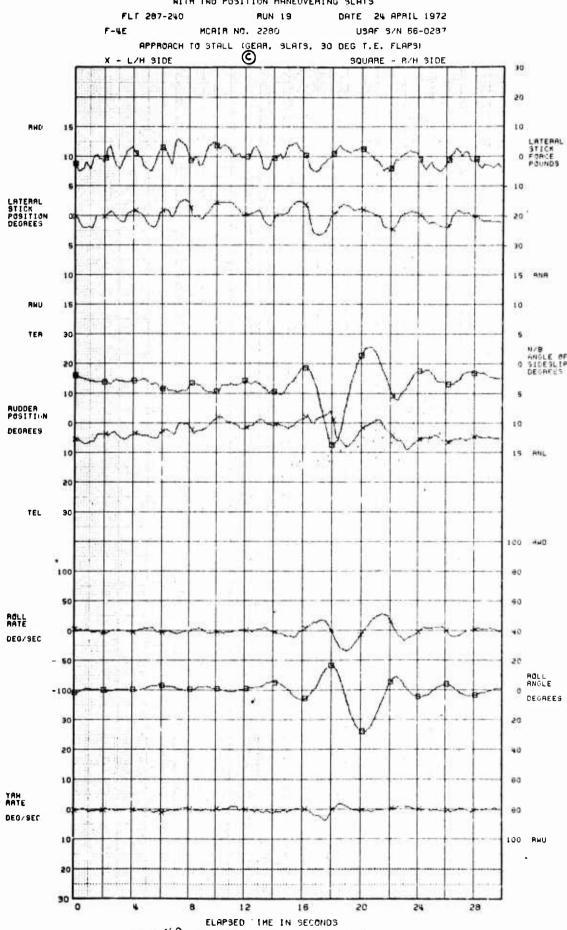
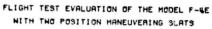
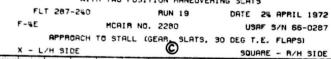
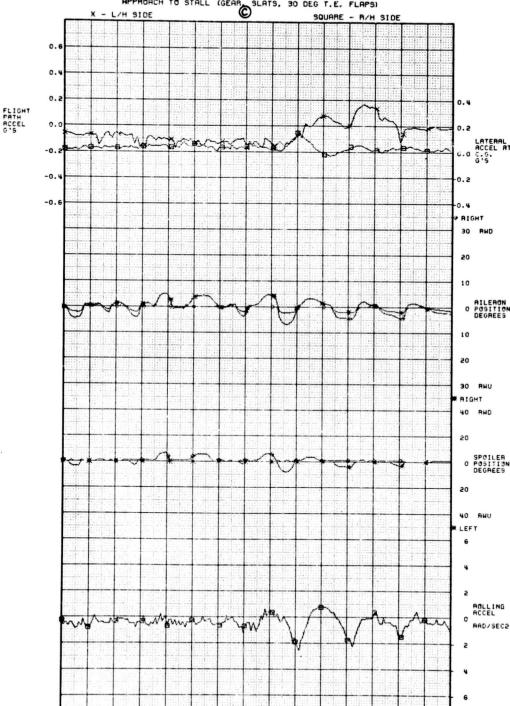


FIGURE 169 STALL APPROACH TIME HISTORY ( CONTINUED )

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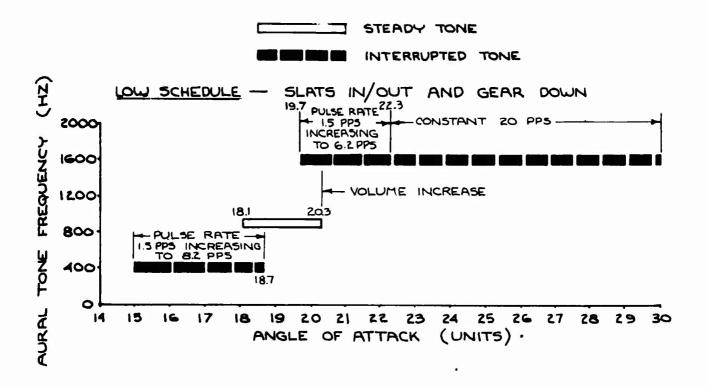




ELAPSED TIME IN SECONDS
FIGURE 169 STALL APPROACH TIME HISTORY ( CONCLUDED )

12

#### F-4E USAF 5/N G6-287A



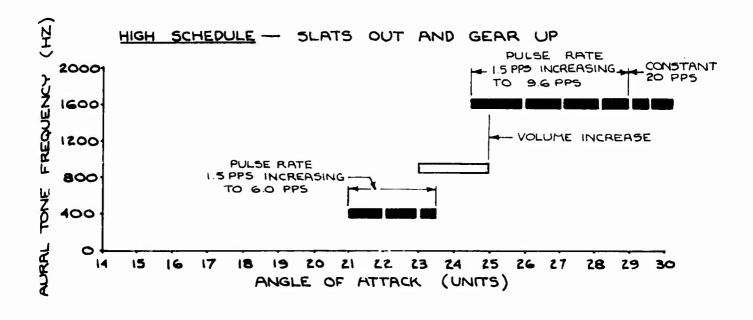
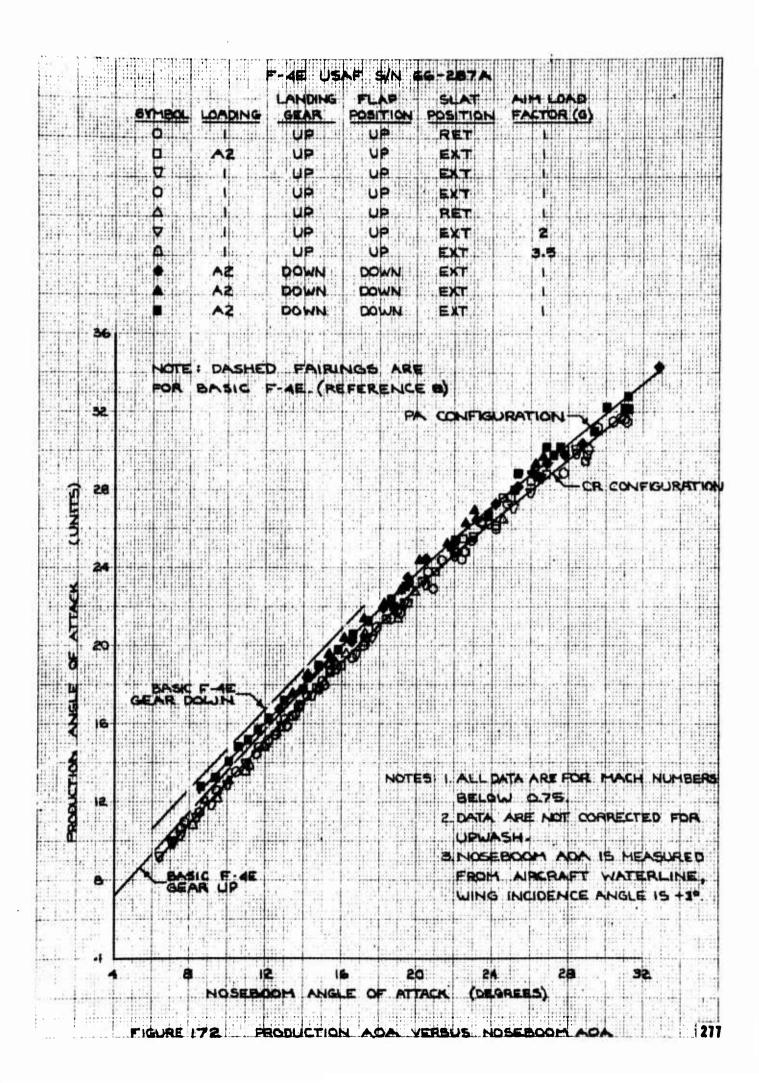


FIGURE 170 ANGLE OF ATTACK AURAL TONE INDICATIONS

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## APPENDIX II TEST INSTRUMENTATION AND FLIGHT LOG

#### TEST INSTRUMENTATION

Test instrumentation used on F-4E, USAF S/N 66-287A, was designed, installed and maintained by MDC. Special instrumentation included a test noseboom, a 14-track magnetic tape airborne data recording system, and a UHF telemetry system.

The test noseboom system was installed on the radome (figure 11). This included a Rosemount noncompensated pitot-static probe, angle of attack and angle of sideslip vanes, and a vane for the Donner dual-axis flightpath accelerometer.

An Ampex magnetic tape recording system was installed in the radome in place of the production radar package. Data was recorded on a 14-track magnetic tape recorder utilizing a pulse duration modulation (PDM) system which incorporates two multicoders and a proportional multiplex (FM-FM) system. Operation speeds for the Ampex tape system could vary from 60 inches per second to 1.875 inches per second. During this test program only 15 inches per second was used. The data recording system was operated from either the front or the aft cockpit.

The test aircraft was also equipped with a UHF telemetry system for real time monitoring of critical parameters and inflight data edition.

Parameter	Range	Units
Altitude (noseboom)	-1K to 60K	feet
Airspeed (noseboom)	80 to 800	knots
Angle of attack (production)	+5 to +35	units
Angle of attack (noseboom)	-10 to +40	degrees
Pitch angle	-40 to +40	degrees
Roll angle	-185 to +185	degrees
Pitch rate	-40 to +40	degrees/sec
Roll rate	-300 to +300	degrees/sec
Total air temperature (noseboom)	-50 to +200	degrees C
Total air temperature (fuselage instal- lation	-50 to +200	degrees C
	-15 to +15	degrees
Yaw angle		-
Yaw rate	-60 to +60	degrees/sec
Normal acceleration at cg	-3.5 to +10	g
Longitudinal acceleration at cg	-1.0 to +1.0	g
Lateral acceleration at cg	-0.5 to $+0.5$	g

Parameter	Range	Units
Flightpath acceleration	-0.6 to +0.6	g
Pitch acceleration	-1.0 tc +1.0	radian/sec2
Roll acceleration	-6.0 to +6.0	radian/sec <sup>2</sup>
Yaw acceleration	-1.0 to +1.0	radian/sec <sup>2</sup>
Nosegear liftoff accelerometer	Uncalibrated	
Stabilator position	10 LEU to 22 LED	degrees
Rudder position	-30 to $+30$	degrees
Alleron position (left and right)	-30 to +1	degrees
Spoiler position (left and right inboard)	0 to +45	degrees
Inboard slat position (left and right)	retracted - extended	
Outboard slat position (left and right)	retracted - extended	
Longitudinal stick force	-25 to +75	pounds
Slat/flap control switch position	norm-extend- retract	
Longitudinal stick force	-25 to +75	pounds
Lateral stick position	-12 to +12	degrees
<pre>rpm (left and right)</pre>	65 to 110	percent
Exhaust gas temperature	0 to 1,200	degrees C
Main engine fuel flow (left and right)	720 to 15,000	pounds/hour
Main engine fuel flow temperature (left and right)	-50 to +150	degrees C
A/B core fuel flow (left and right)	2K to 16.9K	pounds/hour
A/B annulus fuel flow (left and right)	2K to 25.0K	pounds/hour
Total fuel quantity (production)	0 to 100	percent
Individual tank fuel quantities, tanks 1 to 7	0 to 100	percent
Record number		units, tens
Pilot's voice (T/M only)		

### FLIGHT LOG

F-4E USAF S/N 66-287A

Flight Number	Date (1972)	Takeoff (hr)	Duration (hr+min)	Tests Accomplished
228	30 Mar	0940	1+35	Manual and auto slat cycles were performed. Wind-up turns (WUT's) at 0.9 Mach and 35,000 ft, thrust-limited MIL power turns at 20,000 ft, stall approaches to 30 units AOA at 35,000 ft and 30,000 ft were conducted. No external stores.
229	4 Apr	1000	1+05	Max A/B turning performance tests were conducted at 35,000 ft at 1.5, 2.5, and 3.0 g's. Stabilized turns were also performed at 20,000 ft and 2.0 g's. No external stores.
230	4. Apr	1610	0+40	Max A/B turning performance tests were conducted at 20,000 ft with the slats extended and retracted. No external stores.
231	5 Apr	0915	0+35	Mil and max A/B turning performance tests were conducted at 10,000 ft with the slats extended and retracted. Stall approach was conducted at 18,000 ft. No external stores.
232	5 Apr	1230	1+05	Mil and max A/B turning performance tests were conducted at 35,000 ft with the slats extended and retracted. Stall approach was conducted at 18,000 ft. no external stores.
233	5 Apr	1530	0+50	Mil and max A/B turning performance tests were conducted with slats in and out at 20,000 ft, followed by left and right rolls in PA and cruise at 10,000 ft. No external stores.
234	6 Apr	1140	1+25	Static and dynamic longitudinal stability tests were conducted at 10,000 and 35,000 ft, SAS on and SAS off, followed by aileron and rudder rolls at 10,000 and 35,000 ft. External loading: two 370-gallon wing tanks, two MAU-12 pylons, one TER on each pylon, and four LAU-10 rocket pods without end cones on the TER shoulder stations.
235	6 Apr	1600	1+20	WUT's, stalls, and roll performance tests at 35,000 ft. Rolls in cruise and PA, and PA stalls at 10,000 ft. External loading: two 370-gallon external wing tanks, right tank half full and left tank empty. Stability index number = 59.6.
236	17 Apr	1440	0+50	Military thrust accelerations at 40,000 ft, slats in and out. Max A/B acceleration at 40,000 ft to 2.1 Mach. No external stores.
237	18 Apr	0720	1+24	Tower fly-bys in PA configuration. No external stores.
238	18 Apr	1320	1+50	Cruise performance tests at 190,000 W/ $\delta$ and approximately 35,000 ft with no external stores. PA trim was flown at 10,000 ft.
239	21 Apr	1200	1+15	Qualitative flying qualities with asymmetric slat conditions. No external stores.
240	24 Apr	1000	1+15	Mil and max A/B accelerations, WUT's, roll performance tests and stall approaches in PA configuration at 35,000, 20,000, and 10,000 ft, with asymmetric slat conditions. No external stores.
241	24 Apr	1400	1+20	Static longitudinal stability and slat transient check at 10,000 ft. Turning performance test at 35,000 ft. Stall approaches at 35,000, 20,000 and 10,000 ft. No external stores. First AFFTC participation flight.

Flight Number	Date (1972)	Takeoff (hr)	Duration (hr+min)	Tests Accomplished
242	25 Apr	1200	1+20	Static and dynamic longitudinal stability evaluated at 10,000 and 35,000 ft. Lateral control effectiveness was evaluated and WUT's were conducted at 35,000 ft. Stall approaches were performed clean and in PA configuration at 35,000 and 10,000 ft, respectively. External loading: two 370-gallon wing tanks, two MAU-12 pylons, one TER on each pylon, and four LAU-10 rocket pods without end cones on the TER shoulder stations.
243	25 Apr	1600	1+30	Asymmetric slat handling qualities evaluated at 35,000 ft. WUT's were performed at 35,000 ft with the asymmetric slat condition. The PA trim curve was recorded with slats retracted, gear and flaps down. Touch-and-go landings were performed at Scott AFB in various combinations of slat/flap failure conditions. No external stores.
244	26 Apr	0900	1+20	TAC two-position slat evaluation flight. No external stores.
245	26 Apr	1300	1+05	TAC two-position slat evaluation flight. No external stores.
246	26 Apr	1630	0+45	Mil and max A/B accelerations at 40,000 ft were conducted with a decelerating turn. Stall approach at 35,000 ft to 30 units AOA. Air-to-air tracking was evaluated during descent from 35,000 ft. No external stores.
247	27 Apr	0930	1+00	Mil and max A/B accelerations 36,000 ft were conducted with a decelerating turn. Slats out PA trim curve was established at 10,000 ft. No external stores.
248	l May	0900	0+55	Max A/B turning performance test was conducted at 20,000 ft. Asymmetric slat stall approach at 20,000 ft. No external stores.
249	1 May	1300	0+50	Max A/B acceleration and max A/B turning performance test conducted at 35,000 ft. No external stores.
250	1 May	1630	0+50	Max A/B acceleration and max A/B turning performance test conducted at 35,000 ft. No external stores.
251	2 May	0950	0+55	Max A/B accelerations and max A/B subsonic turning performance tests conducted at 20,000 ft. Roll performance test was also conducted in PA configuration at 10,000 ft. No external stores.
252	2 May	1330	0+55	Max A/B accelerations and turning performance tests were conducted at 35,000 ft. A WUT was performed at 18,000 ft. PA sideslip data, SAS on and off were obtained at 10,000 ft. No external stores.
253	2 May	1630	1+20	Military thrust accelerations and turning performance test were conducted at 20,000 ft. Pitch doublets were performed in PA configuration with SAS off at 10,000 ft. No external stores.
254	9 May	0940	0+55	Military thrust and max A/B accelerations were performed at 36,000 ft with a decelerating turn starting at Mach 2.1. Cruise trim curve was established at 10,000 ft. No external stores.
255	9 May	1400	0+50	Accelerations were performed with military thrust at 25,000 ft and max A/B at 36,000 ft. Static and dynamic longitudinal stability tests, SAS on and off, were conducted at 10,000 ft. No external stores.
256	10 May	0740	1+20	Cruise performance was conducted at $50,000~W/^{\circ}$ , with slat switch in NORM. Sideslips were also performed in PA at 8,000 ft, with SAS on and off. No external stores.

Flight Number	Date (1972)	Takeoff (hr)	Duretion (hr+min)	Tests Accomplished
257	10 May	1230	1+10	Military thrust acceleration was performed at 10,000 ft. Static and dynamic longitudinal stability tests were conducted at 35,000 ft, SAS on and off. WUT's were also performed at 35,000 ft. No external stores.
258	10 May	1530	0+45	Max A/B supersonic turning performance tests conducted at 35,000 ft. PA trim curve was also established at 10,000 ft. No external stores.
259	ll May	0900	1+05	Military thrust climb to 35,000 ft, with static and dynamic longitudinal stability tests conducted at 35,000 ft, SAS on and off. Static and dynamic longitudinal stability tests also conducted at 10,000 ft. No external stores, with ballast for forward cg.
260	11 May	1230	0+50	Military thrust climb to 36,000 ft followed by a max A/B acceleration and a supersonic climb to 50,000 ft. A max A/B subsonic climb from 36,000 ft to 50,000 ft was also performed. Stall approaches in PA were performed at 10,000 ft. No external stores.
261	ll May	1530	0+55	Military thrust climb to 36,000 ft. Rudder rolls and aileron rolls were performed at 35,000 ft. AIM-7 missiles in forward stations and gun bay ballast. (Loading la)
262	12 May	1000	1+05	Military thrust climb to 36,500 feet was performed. WUT's and roll performance tests were also conducted at 10,000 ft. AIM-7 missiles in forward station and gun bay ballast. (Loading la)
263	12 May	1340	0+55	Military thrust climb to 36,000 ft with WUT's, subsonic and supersonic, at 36,000 ft. Roll performance tests and stall approaches were performed at 35,000 ft. Airto-ground tracking during descent. No external stores.
264	15 May	1520	0+55	Maximum A/B takeoff was performed followed by a military thrust climb to 36,000 ft. WUT's, roll performance tests and stall approaches were conducted between 36,000 and 32,000 ft. Air-to-ground tracking was also accomplished prior to landing. No external stores.
265	16 May	0935	1+00	Maximum A/B takeoff followed by a military thrust climb to 35,000 ft performed. W"T's at 35,000 and 12,000 ft were also conducted. No reternal stores.
266	16 May	1420	0+35	Military thrust takeoff was performed followed by a military thrust climb to 36,000 ft. Supersonic maximum A/B thrust turning performance test was performed at 36,000 ft. Cruise and power approach stall approaches were accomplished. No external stores. (Flow divider removed and right wing slat restrictor installed to force slats to extend and retract at different rates.)
267	17 May	0900	0+45	A maximum A/B thrust takeoff was performed followed by a military thrust climb to 35,000 ft. Supersonic and subsonic turn performance tests were conducted at 35,000 and 20,000 ft, respectively. No external stores.
268	17 May	1200	0+40	A maximum A/B thrust takeoff was performed followed by subsonic maximum A/B turn performance tests at 20,000 ft with slats both extended and retracted. No external stores.
269	18 May	0900	1+05	This flight was flown with misrigged right outer wing slats to qualitatively determine the flying qualities resulting from production quality control problems.
270	22 May	0930	1+30	Cruise performance was conducted at 200,000 and 180,000 W/ $\delta$ with no external stores. Roll performance tests and sideslips were performed at 35,000 and 10,000 feet, respectively.

Flight Number	Date (1972)	Takeoff (hr)	Duration (hr+min)	Tests Accomplished
271	22 May	1410	1+25	Cruise performance tests were conducted at 140,000 and 85,000 W/ $\delta$ with no external stores. Roll performance tests and sideslips were also performed at 10,000 ft.
272	23 May	0820	1+05	Max A/B thrust takeoff was performed followed by maximum A/B thrust turning performance test at 10,000 ft. No external stores.
273	23 May	1445	1+05	Max A/B thrust turning performance was conducted at 20,000 ft. Cruise and PA aileron rolls, sideslips, and PA rudder rolls were performed at 10,000 ft. No external stores.
274	24 May	1045	1+20	A maximum A/B takeoff was performed followed by cruise performance test at 220,000 W/ $\delta$ with no external stores. Aileron rolls and rudder doublets were also performed at 38,000 ft.
275	25 May	0820	0+45	Supersonic thrust-limited turn performance data obtained at 35,000 ft followed by roll performance test at 10,000 ft. No external stores.
276	31 May	1000	1+40	Ferry flight from St. Louis, Mo. (enroute stop at Cannon AFB, New Mexico). Cruise performance at $180,000~\text{W}/\delta$ was obtained. Three external tanks.
277	31 May	1430	1+30	Continuation of ferry flight from Cannon AFB to Edwards AFB. No data obtained.
278	l Jun	1030	0+35	Pilot canopy was lost shortly after takeoff. Flight was terminated without obtaining test data. No external stores.
279	15 Jun	0830	0+50	Functional check flight for pilot canopy installation. Test data were not recorded during this mission. No external stores.
280	16 Jun	0755	0+30	Takeoff performance was obtained in max A/B. A level acceleration in max A/B to the thrust limit of the aircraft (715 KIAS) was obtained at 5,000 ft altitude, followed by a 5-g WUT. A dive was performed from 30,000 ft to 750 KIAS at 18,000 ft. This was a demonstration by MDC to clear the aircraft to the airspeed limit for the F-4E. Landing performance data were obtained. No external stores.
281	16 Jun	1105	0+35	A max A/B acceleration at 20,000 ft altitude to 700 KIAS was performed, followed by a WUT to 5 g's. Supersonic thrust-limited turn performance data were obtained at 20,000 ft altitude and 1.4, 1.2, and 1.1 Mach number. Roll performance data at 35,000 ft and supersonic were also obtained. Takeoff and landing data were recorded. No external stores.
282	16 Jun	1400	0+35	A max A/B climb to 50,000 ft was performed followed by supersonic turn performance test at 20,000 ft. Takeoff and landing data were obtained. No external stores.
283	19 Jun	0840	0+30	A max A/B acceleration to 710 KIAS at 10,00) ft was performed followed by supersonic turn performance test at 20,000 ft. Takeoff and landing data were obtained. No external stores.
284	19 Jun	1300	0+45	A military thrust climb was performed to 40,000 ft altitude followed by supersonic WUT's at 35,000 and 25,000 ft. Takeoff and landing data were obtained. Two inert AIM-7 missiles aft (on stations 3 and 7).
	20 Jun			Static thrust engine calibration. Data were obtained from idle to maximum afterburning thrust in 5 percent rpm increments for each engine and with both engines operating.
285	22 Jun	0830	1+40	Ferry flight from Edwards AFB to St. Louis, Mo. (enroute stop at Buckley NAS, Colorado). No data obtained.
286	22 Jun	1200	1+30	Continuation of ferry flight to St. Louis, Mo. No data obtained.

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Billy R. Boxwell

Russell C. Hubenet, Sergeant USAF

Cecil W. Powell, Major USAF

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N/A

12 SPONSORING MILITARY ACTIVITY

6510th Test Wing

Edwards AFB, California

The test objective was to evaluate the performance and flying qualities of the F-4E aircraft equipped with the two-position leading edge slat and to obtain data necessary to update the F-4 Flight Manual. The two-position slat test results show an increase in turning capability in most of the flight envelope compared with that of the basic F-4E, and were comparable to those obtained with the previous fixed slat configuration, Agile Eagle IV. The normal takeoff rotation technique described in the Flight Manual was considered unsatisfactory for slatequipped aircraft. The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the F-4 aircraft slightly. Cruise data obtained during the tests show a degradation in cruise performance of approximately four percent for the retracted slat configuration and seven percent for the extended slat. Decreased static stability made precise control of angle of attack(AOA) moderately difficult during landing approaches at 19 units AOA. Rudder rolls performed at high AOA showed improved performance. Lateral-directional flying. qualities in the power approach configuration were generally not as good as with the unslatted F-4E, but were satisfactory. Tests performed to evaluate the flying qualities with simulated failures in one or more slat actuators revealed minor, acceptable degradations from the flying qualities observed with the symmetric slat condition.

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